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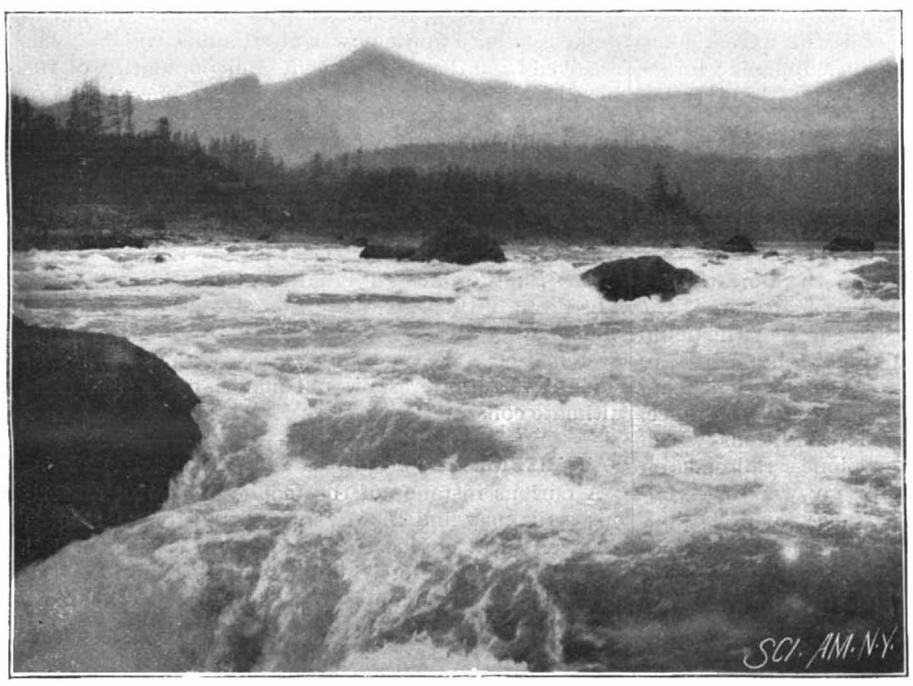
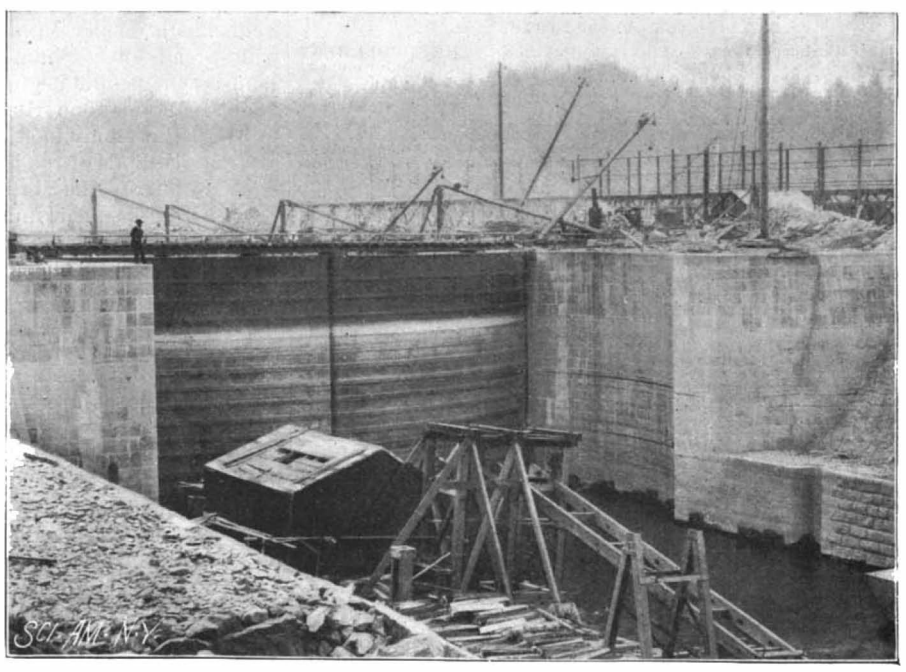
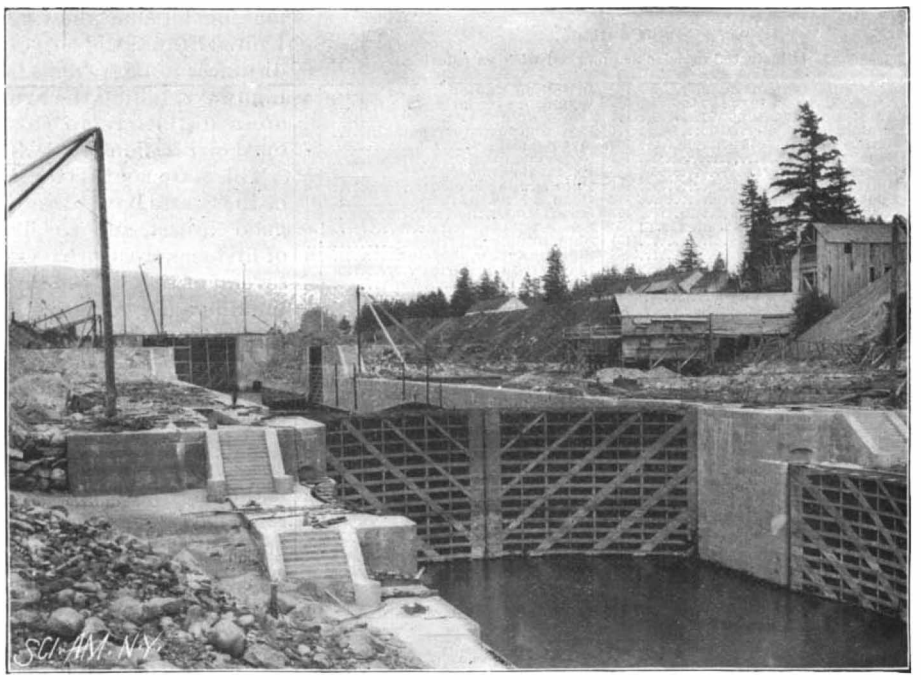


THE CASCADES OF THE COLUMBIA RIVER.



THE UPPER GATES OF THE CASCADE LOCKS.

THE CASCADE LOCKS, FROM THE UPPER GATES.



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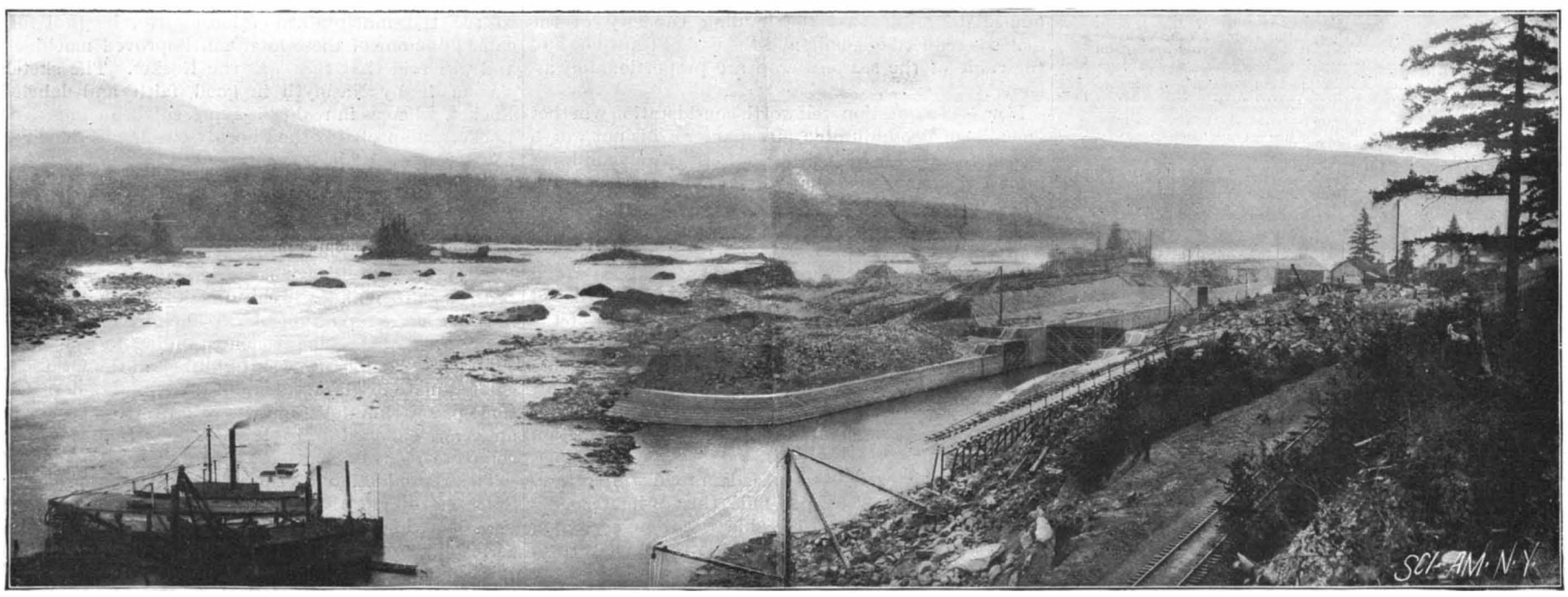

GENERAL VIEW OF THE CASCADES AND LOCKS OF THE COLUMBIA RIVER, OREGON.—[See page 167.]

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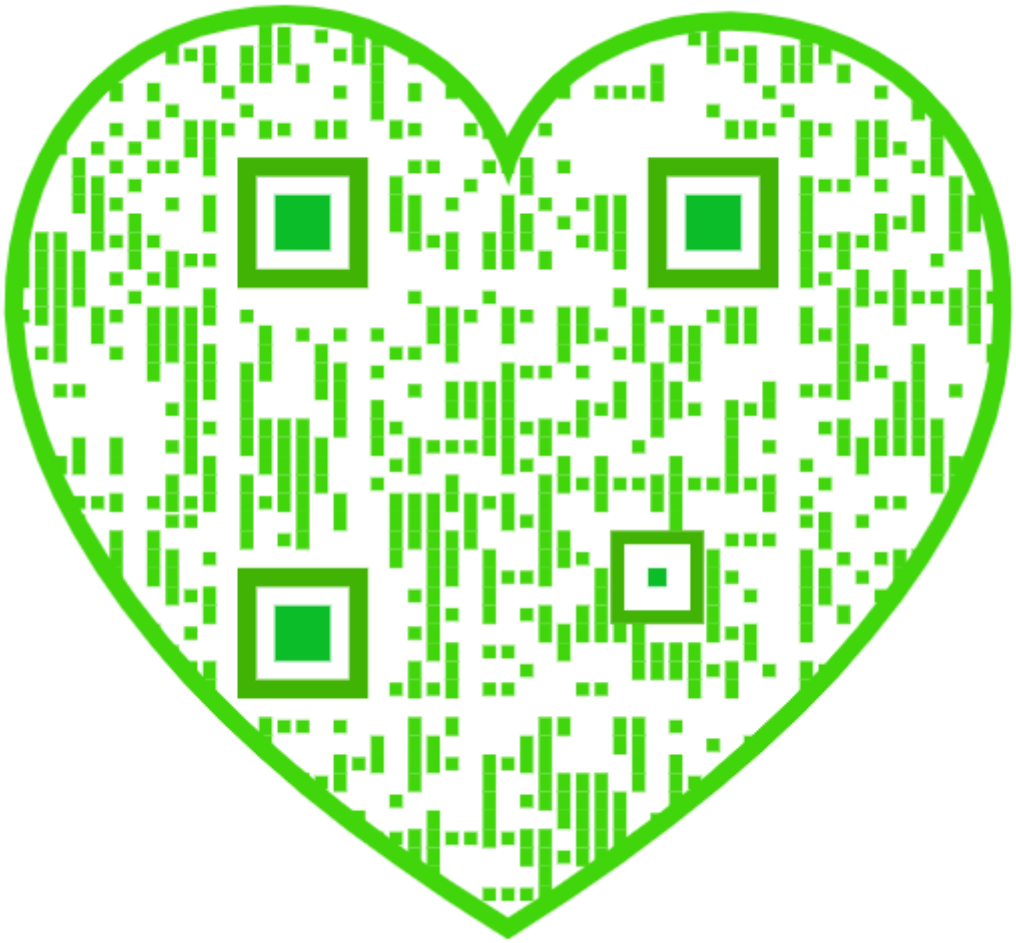

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GOOD ROADS IN RELATION TO FARM VALUES.

The value of a farm is determined to a large extent by its accessibility. Given similar conditions of soil, climate and demand for produce, and the land that is favored with the best transportation facilities, whether by rail, road or river, will bring the best price per acre when put upon the market. The homestead claim of the pioneer, set far back in the virgin forest, has a value that is measurable by the daily necessities of the owner and his family. A farm which is located within a few miles of a railroad or a thriving city, where the conditions are normal, that is to say, where the rates are reasonable and the market not oversupplied, will have a value directly proportional to the condition of the wagon roads by which it is approached.

In view of these self-evident but too easily forgotten facts, the growing agitation in favor of building better roads has a deeper significance and will have a more widespread effect than is generally supposed; for, as soon as the people begin to realize that the question is an economic one that vitally affects our national prosperity, we may look for a thorough reform in the present methods of road building, so far, at least, as a large number of the States are concerned.

At the same time it must be borne in mind that the construction of good roads in this country is a very different task from that presented in the more thickly peopled countries of Europe. The vast extent of the country and the comparative sparseness of the population render it unnecessary and indeed impossible to cover the United States with a network of such magnificent roads as are found, for instance, in France, England or Germany. The same conditions which obliged the engineer to build our pioneer railroads on lines of the strictest economy have governed the construction of our country roads. It may be safely said, however, that both railroads and wagon roads were built with the expectation that they would be subsequently revised and improved in their location and construction. This revision has already taken place or is now being carried out on the railroads, and the improvements are being made as fast as the increase in the traffic will justify it; but it must be confessed that the phenomenal increase in the wealth of the country has not been followed by any proportionate improvement in the condition of our country roads. After making all due allowances for the vast extent of the United States, the large size of the farms and the great distances to be traversed, it must be admitted that our highways, taking the average throughout the country, are a distinct reproach to the otherwise highly developed civilization of the United States.

This statement is made with the knowledge that some of the States have already begun the work of reform in good earnest, and can show as the result of it a system of first-class roads that is extending every year; but of several of the States it must be admitted that they are building and repairing roads to-day according to the primitive methods which were adopted by the original settlers half a century ago—methods which were necessary and adequate then, but are wasteful and inefficient to-day.

When the level prairie lands of the West were settled and devoted to wheat raising, the roads were frequently laid out with a width of eighty feet, and the process of road making consisted in merely plowing up the soil on each side and scraping it to the center to form a raised roadbed. This provided a cheap road, sufficient for the light and infrequent traffic of pioneer days; but with the settling of the country and the increase in the number and weight of vehicles, these roads have proved to be altogether inadequate, especially in the alluvial soils which are common in the wheat raising districts alluded to. The fall and winter rains and the narrow tires of the heavily loaded wheat wagons quickly turn the so-called road into a mere mud track, with the immediate result that the hauling capacity of the teams is reduced one-half, and the cost of transport and the value of the season's crop are proportionately affected.

Now it is a question well worth consideration whether one mile of good, durable macadam road is not worth considerably more in such a district than five miles of plow and scraper road that will go to pieces under one winter's travel. There is food for thought in the fact that the cost of a few years of this temporary work would have supplied such districts as these in question with permanent highways, whose cost of maintenance would be certainly no greater and possibly less than that of the present dirt roads. The mere turning over of the soil is an expedient of doubtful utility at the best, and it is a question whether it would not be good economy to concentrate the labor and material which are now practically wasted in patching a given stretch of road in producing permanent results on a smaller section of it.

A thoroughly well built macadam road will cost, on an average, about $5,000 per mile, this estimate being subject, of course, to considerable variation, according to local conditions, such as are due to the nature of the country and the cost of labor and material. In the more thickly settled and wealthy Eastern and Middle States the expediency of building all the main roads and many of the by-roads with a macadam or telford surface admits of no debate, and its effect in raising the price of farm lands or cheapening the cost of farm products, or both, would be certain and immediate.

Scarcely less important than the question of surface is that of the grades; for it is evident that the existence of but one steep hill between a farm and the railroad may reduce by one-half (no matter how excellent may be the surface of the road) the loads that can be hauled. The location of many of our present roads was determined over a century ago, when economy of first cost was a strict necessity, and, consequently, all heavy excavation and embankment were avoided. They were frequently built with excessive grades, which remain to this day a hindrance to traffic and a constant check upon the development of the districts affected.

No discussion of the cause of good roads can fail to make reference to the powerful stimulus which it has received from the development and popularity of the bicycle. Good roads are the necessary concomitant of a perfected "wheel," and the fascinating pastime is making zealous converts to the cause of better roads who would give it but little thought as a mere economic question. There is a danger, however, lest effort from this quarter should be directed merely to the construction of bicycle side paths, to the neglect of the more serious problem of building permanent highways. The profit of the farmer and the pleasure of the wheelman can both be subserved by building once and forever first-class macadamized roads, and the union of such powerful interests would materially hasten their ultimate construction.

AN INTERESTING POINT IN LOCOMOTIVE HISTORY.

A curious instance of the facility with which a serious error may find its way into the historical records of mechanical engineering is found in the celebrated Nasmyth sketch of Stephenson's locomotive, the Rocket. This engine is in some respects the most famous historical steam engine in the world, and great care has been exercised during the last twenty-five years in gathering up all possible information regarding the details of its design, and giving an exact reproduction of the engine as it appeared on the day of the famous Rainhill trials in 1829. These illustrations are familiar to the majority of our readers, and although they may vary in slight details, they all show the familiar features, such as the inclined cylinders, the lofty smokestack issuing directly from the front end of the boiler, the sloping fire box, and the rude tender, consisting of a cask of water carried on a four wheeled truck.

On July 26, 1884, Mr. James Nasmyth, who is famous as the inventor of the steam hammer, wrote a letter to The Engineer, inclosing a pencil sketch which he said he had made of the Rocket over fifty years before, as it stood on the rails in the year 1830, or one year subsequent to the Rainhill trials. Mr. Nasmyth was a good freehand draughtsman, and the sketch had evidently been made with considerable attention to detail. This fact made all the more remarkable and puzzling the astonishing change which the Rocket appeared to have undergone in a brief twelve months. The smokestack had been cut down and now projected from the top of a smokebox; the wooden driving wheels had been replaced by others of cast iron; the cylinders had been brought down to a nearly horizontal position; the sloping fire box had been entirely remodeled, and the crude tender had given place to one of a very neat and greatly superior design.

As may well be imagined, the publication of this sketch brought forth a mass of correspondence, which went to show that, between the Rainhill trial in 1829 and the opening of the Liverpool and Manchester Railway in 1830, seven other engines were constructed by the Stephensons, and that when Nasmyth went down to see the much-talked-of locomotive, he probably came upon one of these later and improved machines, and was told that that was the Rocket. The sketch was made by Nasmyth in good faith and labeled Rocket, whereas in reality it represented an improved Rocket, and probably the Phoenix, the first of the seven new locomotives above mentioned.

In order to assist its readers in clearing up the difficulty, The Engineer published a reproduction of the Nasmyth drawing and labeled it the Rocket, 1830. Subsequently, it would appear, The Engineer's engraving came to the notice of some imaginative artist, who proceeded to make a highly fanciful picture, placing in the background a typical wayside inn with the soon-to-be-superseded stage coach standing at the main entrance. The picture was published in the form of a colored plate by the Leadenhall Press, of London, and some party, thinking, doubtless, that the date 1830 was an error, changed it to 1829. The fiction was now complete.

The reproduction of this plate in the issue of the SCIENTIFIC AMERICAN SUPPLEMENT of January 30, 1897, has called forth an explanatory letter from a correspondent, in which the origin of the Leadenhall Press engraving is explained. The letter, together with illustrations of the actual Rocket of 1829 and the sup-

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posed Rocket of Nasmyth's sketch, will be found in the current issue of the SUPPLEMENT.

The incident carries a special interest at the present time, when the advisability of gathering up and piecing together the all too scanty scraps of locomotive history is being strongly urged on both sides of the Atlantic.

A NEW PROCESS OF PRODUCING PHOTOGRAPHS IN COLORS.

In a paper read before the Society of Arts, February 24, 1897, by Sir Henry Trueman Wood, secretary of the society, on "The Production of Color by Photographic Methods," he describes the recent process invented by Dr. Adrien Michel Dansac and Mons. V. Chassagne and called "Chassagne's color process," as follows:

"The process, so far as we know it, is as follows: A negative is taken on an ordinary gelatine plate, which has been prepared by treatment with a solution, the ingredients of which are unknown. The negative thus obtained shows no trace of color, and appears in all respects like any other photographic negative. From it a print is taken on ordinary albumenized silver paper, which has been treated with the before mentioned solution; or if a transparency is desired, on a gelatine plate prepared in the same manner as that which was used for the negative. This print shows no trace of color either by reflected or transmitted light. The print when dry is washed over with the solution, and is afterward treated successively with three colored solutions—blue, green, and red—the operation being conducted in a bright light. As the solutions are applied the print gradually takes up its appropriate colors, the intermediate tints being, it is supposed, produced by a mixture or combination of the three primaries. That a yellow color should be produced by a combination of what are presumably green and red pigments is not in accordance with expectation, for though red light and green light when superimposed produce yellow, we do not get yellow by mixing red and green coloring matters. Probably the yellow is produced by the application of a yellow dye mixed in the green solution, and not by a combination of colors.

"It is to be noted that the process is not one for the direct reproduction of natural colors. It is rather one for treating a photographic print in such a way that it enables it, one might say, to automatically paint itself, to take up in the proper parts the colors which are required, rejecting them in the parts where they are not required. How this is effected is at present a mystery, and perhaps with the limited amount of information available it is not worth while speculating upon it. How a monochrome negative can confer on a monochrome print this power of selective absorption has yet to be explained. I can offer no suggestion on the subject. I am informed that a negative of special character is required to produce the colored positives, and that is all I know about it.

"The results certainly are produced, and there seems no reason to doubt the good faith of those who state they were produced in the manner described. Of course when we are thus asked to accept facts without receiving an explanation of them, we require, as I said before, very strong evidence that the facts are genuine. Examination and experiment, so far as they have yet gone, have thrown no doubt on the statements made, and the inventor, I wish to say most distinctly, has offered every facility for inspection so long as the secret of his materials is respected. Sufficient time has not elapsed for crucial tests to be made, but we may reasonably expect that the process will stand those tests as well as it has those to which it has been submitted.

"I have myself seen the colors applied in the way I have described, and the promised results produced. Mr. Herbert Jackson and myself took negatives on Mons. Chassagne's plates of various test objects. Mr. Jackson was afterward kind enough to make some positives from these plates, and neither negative nor positive was touched, or I think seen, by Mons. Chassagne, until we placed them in his hands that they might receive their final treatment. On the application of the coloring solutions, we saw that the proper colors were produced.

"Photographically the results we obtained were very poor; the prints were extremely thin and unsatisfactory, as was not to be wondered at, since the negatives were taken on a dull, foggy day. Nevertheless they showed a great deal more than traces of the proper colors. A blue china vase, with a piece of red ribbon tied round it, and containing a bunch of flowers, was reproduced with perfect accuracy, though the image was thin and faint. An Indian brass pot showed not only the yellow color of the brass, but also distinctly metallic luster. Altogether I can only say that the results of these experiments, so far as they went, satisfied myself, and I think the others who saw them, that the results were produced in the manner described. Were it not for the novelty of the process, and the difficulty of accounting for its results, it would be accepted without hesitation. Whatever hesitation exists is, after all, but a testimony to its importance.

"I have been taken to task by some of my friends for accepting results so remarkable without evidence more substantial. I can only say that I think any of you who saw the process carried out would have arrived at the conclusions at which I arrived. All evidence is a contest of opposite improbabilities. It seemed to me more probable that the colors were produced in the manner stated than that the prints were first painted by hand, then bleached and then the colors restored under my eyes by the application of some mordant; or that the operator, who seemed to be sluicing and dabbing his color all over the print, was really painting it on in the proper places. I can think of no other alternative. Still I freely admit I shall myself like further proof. I look forward shortly to being supplied with the materials, and I shall not be absolutely happy until I have myself produced something which—however inferior it may be to the very beautiful examples we have here to-night—shall yet show the colors of an original subject taken by myself.

"In a secret process such as this it does not seem worth while to speculate. Because it is a waste of time guessing how results are produced that we may expect to have fully described to us in a short time."

PROF. CROOKES ON THOUGHT TRANSFERENCE.

No man of science has contributed anything to the recent discussion of scientific subjects which will appeal more plausibly and more entertainingly to the public imagination than has Prof. William Crookes, F.R.S., in his recent presidential address delivered to the Society for Psychical Research. Prof. Crookes occupies so distinguished a position in the scientific world that he is entitled to the most serious consideration, even though the mind, filled with preconceived theories, seems to reject his arguments. His logic is strong and he makes an excellent point in devoting great attention to clearing away the "scientific superstitions" which may act as stumbling blocks to possible coadjutors who might otherwise trust themselves on the new and illimitable road which the society is endeavoring to open.

Psychical science was, he said, the embryo of something that might in time dominate the whole world of thought. Human ignorance beset research in this direction with many difficulties, but conscious ignorance was a healthful stimulant if it led to the conviction that one could not possibly lay down beforehand what did not exist in the universe or what was not going on in the world. One of the greatest thorns in the path of the society was the fact that very many people started with certain presuppositions depending upon a too hasty assumption that we knew more about the universe than really was known.

Addressing those who not only took too terrestrial a view, but who even denied the possibility of an unseen world existing at all, Prof. Crookes said he would like to point out to them the difference in the apparent laws of the universe which would follow upon a mere variation in size of the observer of them. Following this idea out, he imagined, first, a homunculus of microscopic size. Prof. Crookes puts his imaginary homunculus on a cabbage leaf and speculates as to what would be the Liliputian philosopher's conception of the shape of the world, the laws of nature, and the scheme of the universe. The motes dancing in the sunshine would be to him "cumbrous objects like portmanteaus flying through the air." He would be terrified by the tiniest insects. Next the professor gives as an example a human being of enormous magnitude, showing by familiar illustrations how the supposed laws of matter and of the universe would appear to such beings to be quite different from those now accepted. Was it not possible, he asked, that we also, by the mere virtue of our size and weight, might fall into misinterpretations of phenomena; and that our boasted knowledge might be simply conditioned by accidental environment, and therefore liable to a large and hitherto unsuspected element of subjectivity?

Having cleared the way by means of ingenious speculations for his invasion from the domain of physics into the region usually regarded as that of metaphysics, Prof. Crookes discloses his wave law theory. It is an extension of the well known natural law under which sound is conveyed by vibrations of the atmosphere and light by the vibrations of the thinner ether. He presents an interesting calculation of the number or rapidity of these vibrations.

Was it inconceivable, he said (after making an elaborate calculation as to the vibrations which produce sound and light), that intense thought, concentrated by one person upon another with whom he was in close sympathy should induce a telepathic chain along which brain waves should go straight to their goal without loss of energy due to distance? Such a speculation was, he admitted, new and strange to science; it was at present strictly provisional, but he was bold enough to make it, and the time might come when it could be submitted to experimental tests.

ANY dealer in calcium carbide would do well to advertise the article in the columns of this paper. Letters of inquiry for it come to this office every day, and some days several are received.

RECENT PATENT AND TRADE MARK DECISIONS.

Adams v. Kinzer & Jones Manufacturing Company (U. S. C. C. A., 3d), 76 Fed., 800.

Moulds for Casting Tubular Articles.—The Adams patent, No. 465,771, for moulds for casting tubular articles, consisting in the use of a runner extending through the sand into which the metal is poured so that it wells up into the mould from below, does not cover a device such as is shown in Fig. 3 of that patent, which is designed for a pattern that is straight or tapers toward the lower end and can wholly be drawn from the upper end.

Edison Electric Light Company v. Kaelber (U. S. C. C., N. Y.), 76 Fed., 804.

Suit for Infringement Against an Agent.—In this case Kaelber was sued in New York as the agent of the Western Electric Company, a non-resident corporation, upon the theory that a contract for the installation of an electric plant within the jurisdiction had been awarded to the Western Electric Company, which, if performed according to the specification, would involve infringement. Kaelber in his answer upon oath denied infringement, and there was no proof that the plant had been installed. All that was proved was the statement of a witness that the contract was awarded to the Western Electric Company, through its agent, Mr. Kaelber. The court held that there was not sufficient proof of infringement, as the experts on either side were equally positive in asserting and denying that the performance would involve infringement, and also that there was not sufficient proof that Kaelber was connected with such infringement.

Dodge v. Post (U. S. C. C., Ohio), 76 Fed., 807.

Separable Pulleys.—The Dodge and Phillion patent, No. 260,462, for a separable pulley, in which the meeting ends of the rim are in contact and the meeting faces of the spoke bar and hub are slightly separated, so that they may be compressed by clamp bolts upon the shaft, has been held valid and infringed.

Evidence of Prior Use.—The defense of prior use must be established beyond a reasonable doubt, the proof must be as explicit and convincing as that required to convict a person of crime, and a fair doubt of the reliability of the testimony or an inherent improbability in the story told is sufficient to dispose of the defense.

What Amounts to Invention.—In determining whether an alleged improvement is an invention, a fact tending to show invention is that the device, when first presented to those skilled in the art, was pronounced inoperative and its adoption was refused until the inventor overcomes such distrust and disfavor by actual test and use. In addition to this, the fact that the device went into general use and the demand for it steadily increased until they were manufactured in very large numbers is evidence tending to show the presence of invention.

Mast, Foos & Company v. Iowa Windmill and Pump Company (U. S. C. C. A., 8th), 76 Fed., 816.

Pumps.—The Bean reissue patent, No. 8,631, is void for laches in applying for the reissue, which enlarged the claims so that they included a subsequent construction.

Delay in Applying for a Reissue Patent.—A delay of nearly three years in applying for a reissue enlarging the claims of a patent renders such reissue void, where in the meantime a new device has come into use not covered by the original claims but which is brought within the claims of the reissue.

Baldwin v. Kresl (U. S. C. C. A., 7th), 76 Fed., 823.

Cigar Moulds.—The Miller & Peters patent, No. 258,940, is void for want of invention, in view of the prior art and as being for a mere change of degree without change of function.

Pleading of Defense of Want of Invention.—The defense of want of invention, including the right to show the prior state of the art, need not be set up in the answer, as it is always open for the defendant.

Rowlett v. Anderson (U. S. C. C., Ind.), 76 Fed., 827.

Lawn Mowers.—The Rowlett patent, No. 383,829, for a ratchet mechanism in lawn mowers, has been construed as to claims 2, 3, 4, 5, and 8 and limited to the specific combination claimed or its fair equivalent.

Extensive Use as Evidence of Invention.—The fact that a machine or device has met with general favor and acceptance by the trade is not of persuasive force in favor of a broad construction, when, in view of the prior art, there is no doubt about the limitations that must be placed upon the claims.

LUTHER HENRY TUCKER.

The agriculturists throughout the country will regret the death of Mr. Luther H. Tucker, senior editor and proprietor of the Cultivator and Country Gentleman, of Albany, N. Y., on February 23. For many years he conducted this eminently popular paper devoted to the interests of farmers and stock breeders.

Mr. Tucker was born at Rochester, N. Y., in 1834, and graduated at Yale College. At an early age he adopted journalism as his profession, and pursued it to the end of his life.

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A TWIN HOUSE.

We present an engraving of a most excellent design for a pair of houses, built of stone and mortar, and embracing a new idea in twin houses. The buildings have been recently erected for the Overbrook Farms Company, at Overbrook, Pa. The design is treated in the English Gothic style of architecture. It has many unique features, and the most striking and novel one is the verge boards at gables, which are very handsomely cut and executed. The brick wall rising up through roof and between the buildings is a dividing line, and according to the ordinance of Philadelphia. The first story is built of Chestnut Hill granite of a bluish gray color; the second story is plastered. The gables are beamed, forming panels which are filled in with similar plaster work. The roof is shingled and finished natural.

Dimensions: The front is 100 feet, including both houses, and the depth 35 feet, exclusive of piazzas. Height of ceilings: Cellar, 7 feet; first story, 9 feet 6 inches; second, 9 feet; third, 8 feet 6 inches. Both houses are trimmed alike, so a description of one will suffice for the other. The plan is most excellent, and the apartments are so arranged as to be provided with light and ventilation at both ends of the room. The vestibule is paneled in oak and provided with a tiled mosaic floor. Hall is trimmed with oak, and is furnished with a paneled wainscoting and ceiling beams. It contains a nook, separated by a spindle transom and archway, and provided with a paneled seat and an open fireplace built of brick and furnished with a tiled hearth and a mantel made from special design.

The staircase is a very handsome one, and is fitted up with carved newel posts, balusters and rail; it is lighted effectively by stained glass window on first landing. Parlor is treated in white and gold, and is furnished with a fireplace with tiled hearth and facings, and a mantel to correspond with the trim. Dining room is trimmed with oak. It has a paneled wainscot and seat. Kitchen is isolated from the other apartments by the butler's pantry and rear hall, which is a good feature. This kitchen is trimmed and wainscoted with yellow pine, and is fitted up complete with the best modern conveniences. The second floor is trimmed with sycamore, and it contains four bedrooms, closets, and bathroom, the latter tiled and furnished with the usual fixtures and exposed plumbing. Third floor contains two bedrooms and trunk room. Cemented cellar contains laundry and other necessary apartments. The house is electric wired for call and light, and is heated by the central plant. Cost $15,000. Mr. W. L. Price, 731 Walnut Street, Philadelphia, Pa., was the architect.

Our engraving was made directly from a photograph of the building, taken specially for the SCIENTIFIC AMERICAN Building Edition.

A BICYCLE SKIRT PROTECTOR.

A bicycle attachment to prevent mud from being thrown by the rear wheel on the rider, and to protect the skirts of a lady, preventing their being blown about by the wind or being caught in the chain or wheel, is shown in the accompanying illustration, and has been patented in the United States and England by John G. McNaughton, of Salisbury, N. C. It consists principally of a mud guard, preferably made in the form of an eagle bending over the rear wheel, with his head pointing rearward and his wings extending outwardly on each side. It is rigidly mounted on the frame, and the wings are hinged and provided with springs to keep them distended, while allowing them to fold inwardly should the bicycle fall on its side. Just back of the crank axle are bearings in which are hinged legs, preferably made of a continuous U-shaped bar, the legs simulating to some extent those of an eagle, and having at their extremities claws grasping bearing blocks to contact with the ground and hold the bicycle upright when still, while also adapted to serve as brakes when it is desired to stop the machine. Rigidly attached to the middle portion of the bar forming the legs is an elbow connected to a slide rod, and the latter is connected to a hand lever fulcrumed in convenient reach of the rider, whereby the legs may be thrown down to serve as a brake, or as supports when the rider dismounts.

McNAUGHTON'S BICYCLE ATTACHMENT.

A Curious Electrical Accident.

The power house at Thirteenth and Mount Vernon Streets, Philadelphia, from which the Union Traction Company operated a half dozen of its lines of trolley cars, was destroyed by fire on the evening of March 3.

About 6 o'clock some of the employes were swinging a big crane around, and the iron chain hanging from the arm struck a generator. The blow smashed the generator and a violent explosion followed. The breaking of the generator blew out every circuit and wrecked all the dynamos which were running.

Following the explosion, fire started and gutted the building and destroyed the eight dynamos or rendered them useless. The dynamos were the property of the Westinghouse Electric Company, as the traction company said that they were not working properly, and had therefore never accepted them, and the Westinghouse Company were running them at their own expense, pending some decision in the matter. The loss is about $500,000, principally on the valuable machinery in the building. The power house was a large brick structure, covering a third of the block, and contained eight dynamos and other valuable machinery.

Soldiers' Beds.

The soldier's bed varies notably in the different European armies. According to Dr. Viry, the following are the principal varieties, in which, perhaps, we may see the reflection of national characteristics, says the Medical Record. In England the bed is hard; the soldier lies on a thin mattress that rests on canvas stretched over a frame. In Spain the soldier has only a straw bed, but he is allowed besides this a pillow, two sheets, two blankets, and a covered quilt, sometimes even a cover for the feet. It is almost sybaritic. In Germany and Austria he has a simple straw bed with one or two covers, neither sheet nor mattress. In Russia, until recently, the soldier slept with his clothes on, on a camp bed; but now ordinary beds begin to be used—the result of contact with more civilized countries. After this, it cannot be doubted that the French soldier's bed is the best of all, with its wooden or iron bedstead, a straw bed, a wool mattress, sheets, a brown woolen coverlet, and an extra quilt for cold weather. Thus the bed of the French soldier is the softest of all soldiers' beds, as that of the French peasant is acknowledged also to be the best of all European countries.

A PREPARATORY Antarctic expedition will start from Melbourne during the summer and will pass the winter on Victoria Land. The main expedition, with two ships, will set out after the return of the first expedition and will proceed southward along the meridian of Kerguelen Islands. One of the ships is to remain there while the other will attempt to reach the magnetic pole and the south pole.—Der Stein der Weisen.

A DOUBLE DWELLING HOUSE AT OVERBROOK FARMS, PA.

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A FOLDING BICYCLE.

The bicycle, as ordinarily constructed, has only one real fault, which is that it is a clumsy machine to transport. It is difficult to ship an uncrated bicycle by rail or water without its running some risk of being injured. The folding bicycle largely obviates this difficulty and also permits of the wheel being stored in houses with great convenience, but the folding bicycle has another and often more valuable use. In France, where the bicycle has been made considerable use of in military maneuvers, the folding bicycle has been used with great success. The construction of the ordinary bicycle, valuable as it is in transporting soldiers, becomes, as soon as he dismounts, a hindrance to his motions and a burden which cannot be carried with ease, but must be trundled along.

Under such circumstances it is difficult to see how a soldier can handle a gun. If he lays his bicycle upon the ground, it runs a great risk of being injured and would offer an impediment to the free movement of the troops, and, if surprised by the enemy, it may cost him the loss of it; like a rider without a horse, he would be very liable to be captured. Military bicycles often have to be transported very long distances through woods and swamps and hoisted over hedges and walls. The difficulty appears to have been solved by causing a machine to be constructed which can be carried by man when man cannot be carried by the machine. Various devices have been made to permit this folding. We illustrate an American invention of this class, the wheel in our engraving being made by the Dwyer Folding Bicycle Company, of Danbury, Conn. We illustrated the folding military bicycle of Capt. Gérard in our SUPPLEMENT, No. 1044. This bicycle has been put to actual use in military maneuvers and has been found very satisfactory. The Dwyer machine is arranged so that both diamond and drop frame wheels can be built capable of folding.

In the diamond frame wheel the joint is arranged in the middle of the frame, and in the drop frame wheels a similar plan is employed. The wheel is manipulated as follows: Stand on the left side with the left hand on the handle bar (to keep the front wheel from falling around) and the right hand on rear brace. Then press bolts forward and into recesses in locking tube, and with right hand lay rear wheel around against the front. If an ordinary handle bar is used, set the handle bar and saddle so that the handle bar will go under or over the horn of the saddle. Special handle bars make the folding more compact. The military wheels are especially ingenious and do not differ much in appearance from the ordinary drop frame wheel. It is the work of an instant to fold the bicycle. The soldier can then have free use of his hands to assist him in climbing or handling his gun while the wheel is hung over his shoulder. The folding bicycle proves especially valuable to those who wish to make excursions on boats and cars. The wheel can be folded up and placed in the cabin of a very small yacht. The folding bicycle is especially convenient when it is desired to take it into the house and the wheel is reduced to so small a compass that it can be readily packed in a trunk or box. The wheel has as much strength as the ordinary bicycle and it weighs only twenty-five pounds.

THE DWYER FOLDING BICYCLE.

THE Chilean government telegraph lines comprise 7,500 miles.

AN ELECTRIC HANSOM.

During the past year we have received hundreds of letters regarding horseless carriages. These letters have come from all over the civilized world. The correspondents have usually either anxiously inquired whether the automobile vehicle was in reality a practical means of transportation or where such vehicles could be purchased.

The number of American built motor carriages which have been offered for sale has been small, and the few manufacturers who have pretended to do any business have been somewhat reluctant to put carriages upon the market. In this respect they have been wise, and their action will only result in doing good to the motor industry. In its present state of development the horseless carriage can hardly be trusted in the hands of those who have not some acquaintance with machinery or those who may not be favorably disposed toward the new vehicle. The three races which have been held in America have had the effect of awakening public interest in the subject, if they have subserved no other useful purpose. If the manufacturers had greater capital at their command, the perfecting of their machines would have proceeded at a more rapid rate, but the results would probably not have been more satisfactory. We are glad to be able to chronicle the fact that for the first time in America the horseless vehicle has now entered into competition with the public cab in the city of New York.

The Electric Carriage and Wagon Company, which has offices at 66 Broadway and a depot where cabs may be hired at 140 West Thirty-ninth Street, has now several electric hansom cabs which will be hired at the legal rate of the public cabs. In a short time twelve of these vehicles will be at the disposal of the public and an electric brougham will probably be added. It will be little wonder if the public does not take favorably to these handsome vehicles, which seem the perfection of the carriage maker's art.

Unlike the ordinary hansom cab, they are mounted on four wheels. To an ordinary cab body a battery box is attached, forming an extension in the rear. Upon this is situated the seat for the driver. The weight of the carriage is about 2,500 pounds, the weight of the batteries alone being from 800 to 900 pounds. The diameter of the large wheels is 43 inches, while the diameter of the small wheels is 32 inches. The wheels run on ball bearings that have tangent wire spokes, steel rims and thick pneumatic tires. Each of the front wheels is connected wfth a motor of the Lundell type, of nominal 1½ horse power. Each motor is inclosed in an iron case and drives each wheel independently. The pinion from the armature shaft meshes with the internal gears of the wheels. The internal gears permit of turning corners with ease. The storage batteries which are used are supplied by the Electric Storage Battery Company, of Philadelphia, Pa. They are chloride accumulators of 70 ampere hours capacity. It is arranged so that automatic connection is made when the batteries are run into the battery container, by means of contact plates, and fuses are provided as a safeguard. The controller is situated at the left side of the driver's seat, so that it is easily manipulated with the left hand. There are three speeds forward and one speed backward. The first notch of the controller gives a speed of five miles per hour; the second notch, eight to ten miles; the third, thirteen to fifteen miles. Fifteen miles may be regarded as about the maximum speed which is desired or can be obtained with the hansoms. These speeds are obtained by various groupings of the batteries and motors in series and parallel.

Directly in front of the driver is a lever which controls the steering mechanism, which is extremely ingenious. The steering is accomplished by turning the rear wheels parallel with each other from a point directly over the tread of the wheel. The wheels are connected by rods to a vertical lever of a convenient height to be operated from the front seat of the carriage. In reality the steering mechanism looks like an enormous hollow hub which turns freely, horizontally, upon the vertical rod which supports the body of the carriage. The steering mechanism enables the carriage to be turned completely around in a very short space.

A powerful roll-

THE NEW ELECTRIC HANSOM CABS IN USE IN NEW YORK CITY.

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er brake adds to the safety with which the carriage can be driven, but one of the things that is remarked by persons who ride for the first time in the horseless carriage is the ease with which it may be stopped. In this respect it compares very favorably with any horse vehicle. From the driver's seat the doors of the cab are also opened and shut and the electric light is turned on or off. An electric bell under the footboard gives warning of the approach of the almost noiseless vehicle, and when used with discretion will add very much to the safety of the carriage.

Each of the carriage lamps has an incandescent lamp, and there is also an incandescent lamp in the cab, so that the passenger can sit and read if he desires. A speaking tube runs from the interior of the cab to the driver's seat, where the mouthpiece is secured by a holder, connection being made with a flexible tube. The attention of the driver of the carriage is attracted by a whistle which is actuated by a rubber bulb in the inside of the cab. This bulb forms the mouthpiece of the speaking tube, a plug being removed when conversation is to be held with the driver.

The motion of the cab is pleasant in the extreme. There is no vibration such as is often found in carriages driven by one of the petroleum products. The ease with which the electric carriage can be started and stopped, the absence of vibration and disagreeable odors, are points in its favor. The batteries afford power sufficient to propel the carriage from 18 to 25 miles on the level, depending upon the state of the road. With a private plant the batteries may be charged at an expense of from ten to twelve cents. The cost is increased where the electricity must be purchased. It is estimated that the carriage can be run at an expense of about a cent per mile. Riding in a hansom cab of this kind is pleasurable in the extreme. There is nothing whatever to interrupt the view of the passenger.

The carriage proper was built by the Charles Caffery Company, of Camden, N. J., and the motors were built by the Interior Conduit and Insulation Company, New York City. The carriage was invented by Messrs. Morris & Salom, of Philadelphia, Pa. It will be remembered that their "Electrobat" obtained the gold medal at the Chicago Times-Herald race in 1895 upon the following points, to quote from the report of the judges: "Safety, ease of control, absence of noise, vibration, heat, odor, cleanliness and general excellence of design and workmanship." We illustrated the "Electrobat" in the SCIENTIFIC AMERICAN for November 16, 1895. At the Providence race the Electrobat made five miles in 11 minutes 27 seconds, average 2·17, or at the rate of 26·2 miles per hour. The officers of the Electric Carriage and Wagon Company are Isaac L. Rice, president; W. W. Gibbs, vice-president; and the superintendent of the new depot for horseless cabs is Edwin A. Adams.

Electricity from Carbon Without Heat.

In a paper read before the New York Electrical Society Mr. Willard E. Case gave some interesting information and experiments on "Electricity from Carbon Without Heat," a subject which he has been studying for some years. The lecturer described the devices thus far employed to oxidize carbon without heat in the electric battery.

The lecturer had his apparatus with him and performed experiments before the audience. He used a cell of his own invention. Plates of tin and platinum formed the electrodes, and the carbon being oxidized by contact with chemicals, electricity was produced, as was shown by attaching the wire from the cell to a motor. A thermometer applied at various stages showed that no heat was generated; hence, practically, the entire energy of the chemical charge was converted into electricity. Having concluded this experiment, Mr. Case brought out the possibility of the discovery of a method of obtaining electricity from carbon without heat, by following plans analogous to the method employed by nature in the human system. He drew attention to the processes going on in animal organism by which the carbon is oxidized by the instrumentality of the hæmoglobin of the blood, which acts as an oxygen conveyor.

The point Mr. Case specially dwelt upon was that work in the direction of rendering the experiment of practical value lay in the suitable preparation of the carbon for the oxidizing material to act upon.

The hæmoglobin cell was a fine example of what many scientists have, for a long time, insisted upon, namely, that the closer the processes of nature can be approximated, the nearer and quicker they will come to attain their end.

WE learn that the Barnes Cycle Company's large works, at Syracuse, New York, were destroyed by fire on the 4th instant, but, with commendable energy, temporary quarters were immediately obtained sufficient to enable the company to continue the business regularly during the rebuilding of the works. The feature of the Barnes cycle is the frame connection and solid cranks and axle forged in one piece.

An Explosion Over the Subway at Boston.

An explosion of gas which leaked from the two six inch mains which cross the Boston Subway for the trolley cars at the corner of Tremont and Boylston Streets occurred on March 4, killing six people and injuring nearly fifty, some of whom are liable to die. The explosion sounded like the boom of a cannon, and it was followed by smoke and flames which shot up from the intersection of two of the busiest thoroughfares in the city. The explosion occurred just as three cars were close at the intersection of the streets. One car was almost exactly over the center of the excavation when the explosion came.

The whole of the woodwork which is used as a bridge over the deep cutting at this place, was lifted into the air, carrying the car with it and taking along the two horses of a second car. Instantly the air was filled with débris.

The first car, in which most of those that were killed were riding, no sooner fell back on the tracks than it broke into flames. A fire alarm was turned in, and soon a large rescue force was at the scene. Ambulances were also summoned, and one hundred and fifty police were required to keep back the crowd of people. The damage to the buildings in the neighborhood was quite considerable, many windows being broken. The exact cause of the gas explosion is unknown, but it was thought by some that it was started by a spark from the wheels of the electric car in contact with the rails. The mayor of Boston has ordered an investigation.

Tempering a Spring.

It is not every smith who knows how properly to temper a spring. It is not a hard job to some smiths, but other smiths, professional and amateur, claim that it is. In getting ready to temper a spring, one should begin with the forging itself, for if that be not well done, no amount of "know how" can make a successful tempering. The forging should be done with low heats and light blows, and the steel should not be hammered while cold, with heavy blows at least. Avoid making hammer marks in the steel when forging, for, although such marks may be worked out, they do not add to the strength or long life of the spring. A good many failures of seemingly perfect springs could doubtless be traced to this little point in the forging. After the spring has been hammered to size, spend a little extra time in lightly hammering the steel when it is nearly cold—but don't strike hard. The light hammering will toughen the steel and make a better spring. The outside surface or "skin" seems better adapted to spring work where the surface is hammered up, instead of being filed or ground. After the hammering is done, polish the spring with a bit of emery paper. It is best not to put it on an emery wheel, for then the skin above mentioned would be destroyed. Sometimes, however, it is necessary to partly shape the spring by grinding; but let this be done at an early stage of the job, so that the outside skin may be restored as much as possible. When ready for the hardening, there are two ways of doing the heating—either by holding the spring over a clean fire with a small pair of tongs, keeping the spring high up so that it will heat slowly, or by first heating a heavy piece of iron red hot, and then placing the spring on that until the steel is heated.

When the spring is fully and uniformly heated to a light red, plunge into cool, but not ice-cold, water. The amount of twist that is got in the spring by this operation depends on the manner in which the spring is put into the water. If it be put in so that a flat side touches first, the sudden cooling of that side will cause the spring to be pulled out of shape, and held there by the subsequent cooling of the rest of the spring. If put into the water endwise, or straight, there will be but little distortion of the spring. After hardening, polish the steel with a bit of emery cloth until the metal is bright, clean and white, then put a few drops of oil on a bit of paper, light it, and hold under the spring until every portion of its surface is covered with a thick coating of smoke. Next heat the spring slowly, holding it high up over the forge fire until the smoke is all burned off; but it should all go alike. Don't let one part of the spring get so hot that the smoke is all burned off while another part is thickly coated. That means a spring of uneven temper, that will break in short order. When the smoke has been carefully burned off, lay the spring on the ashes of the forge to cool slowly, and in a few minutes it will be ready for work.—Scientific Machinist.

DR. LEWIS HALLOCK, for many years the leading homeopathic physician in this city, died at his residence, No. 34 East Thirty-ninth Street, on March 3. He was ninety-three years old, and up to the time of his last illness a few weeks ago, he was in active practice, and but few of his young associates in the profession were more prompt in answering the calls of his patients, or nimble in ascending the stairs to a sick room. Dr. Hallock was a man possessing rare qualities, and he will be sadly missed by many of the older families in this city.

Science Notes.

Dr. Nansen is to receive the degree of doctor of science from Cambridge University this month.

The Prefecture de Police, in Paris, is reported to be in negotiation with reference to the conversion of the existing horse-drawn prison vans into motor vehicles.

The mountainous country south of Oaxaca, Mexico, has been greatly disturbed recently by severe earthquake shocks, and the people in some of the small villages were so alarmed that they left their homes and went to Oaxaca. The shocks caused considerable damage to property.

Nansen asserts that scurvy can easily be avoided in Arctic expeditions by the use of properly preserved meat and fish, supporting the theory of Prof. Torup, of Christiania, that the disease is due to poisoning from bad meat. Scurvy was not so long ago the usual attendant of all long sea voyages.

The conditions of the heavy motor car competition which is to be held in the neighborhood of Paris, early in July, under the auspices of the Automobile Club de France, have now been announced. The competition is open to all nationalities, and for each vehicle entered an entrance fee of 200 fr. must be paid. Medals and diplomas will be granted to the vehicles which, in the opinion of the judges, best fulfill the conditions of the competition.

Superintendent Knoll, at the Hudson Street Hospital, New York City, recently completed an X ray photograph clearly outlining the brachial artery in the right arm of an adult. This is said to be the first time such a feat has been accomplished. The patient, who was sixty years old, had been suffering from an affection of the arm. The physicians were unable to tell exactly what was the matter. The photograph clearly shows deposits of lime salts in the blood, which has hardened the artery. The treatment of the case was governed accordingly.

A four year old infant prodigy was exhibited recently before the Berlin Anthropological Society. He is the son of a butcher, and at two years of age learned to read without assistance. He knows the dates of the birth and death of all the German emperors and many other noted persons, and their birthplaces, the chief cities of the world, and all great battles. He can read anything in print and can talk intelligently about it, but finds it hard to learn to write and draw, dislikes music, and hates pianofortes. The boy is physically well developed, though not robust.

An interesting report on Mount Kosciusko, the highest mountain in Australia, has been prepared by the Rev. Milne Curran, who is working as a roving geologist under the New South Wales government. Mr. Curran has, after a careful examination, come to the conclusion that the "glacial epoch in Australia," in post-tertiary times, as theorized by Dr. Lindenfeld, has no foundation, as he can find no tangible evidence of glaciers in the present valleys round the mountain. There is no evidence whatever, according to Mr. Curran, of extensive glaciation on the Kosciusko plateau.

"Recently," writes Dr. G. H. Stover to the Medical Record, from Eaton, Col., "having occasion to apply an ice bag to a limited area of the face, and not being near a supply house, I had the patient's husband make a bag from a section of an old inner tube of a bicycle tire. One end was sealed with a bicycle cement and after the cracked ice was put in, the other end was folded over and encircled by a cord. This plan could be used in making ice bags for the face, mastoid, larynx, spine, groin, or in fact for any part where the application of ice to a limited area is desired. Again is 'the bicycle in therapeutics' in evidence."

That petroleum can be produced, or at least imitated, by proper treatment of linseed oil, has been announced by Prof. Sadtler, says the Popular Science News. It was shown that by subjecting this oil to destructive distillation, under pressure, various products identical with certain petroleum hydrocarbons can be produced. This fact is of great significance and importance. It bears directly upon and affords proof of one of two theories regarding the origin of petroleum. These theories are: one, that petroleum is of animal origin, the other that it is of vegetable origin. Possibly, perhaps probably, both are true. Without discussing the theory of animal origin, Prof. Sadtler's results would seem to prove the other.

"Prof. Schmiedeberg, of Strasburg, lately made a very interesting experiment," says the National Druggist, "which not only conclusively demonstrates the existence of an iron hunger in animals, but also indicates disastrous results in the event of the craving remaining unsatisfied. A strong, frolicsome dog, that had suffered the loss of a small quantity of blood only, was fed for a period on pure milk, and little by little became so weak that all evidence of spirit vanished, and, refusing further nourishment, became so thin and weak that his limbs refused to support his body. Just as he seemed on the point of death, a gramme of ferratin was added to his daily allowance of milk; when, instead of refusing, as heretofore, he devoured it ravenously, and in the space of two weeks recovered his normal health and strength."

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CASCADE LOCKS.

BY EDW. K. BISHOP.

On November 5 of last year occurred the ceremonies which formally opened for business the Cascade locks on the Columbia River—a proceeding of great moment to the Pacific Northwest and one which will make a reality of the long dream of an "open river to the sea." Few in other parts of the country appreciate the magnitude of these locks, rivaling those at Sault Ste. Marie in size, and affecting a territory about double the area of the State of New York. The value of opening the river was appreciated in Congress at an early day, and work on the locks was commenced twenty years ago, a small appropriation having been made for the purpose, but progress was very slow till 1892, half of the work being executed since that time.

Their completion at this date is due in a large measure to the efforts of Major Thomas H. Handbury, who succeeded, in 1888, Captain Powell, in charge of all the government improvements on the Columbia River. He called attention to the meager appropriations which had been made—the annual average for the twelve years the work had then been in progress having been only $95,000—and stated that, at this rate, twenty-four years would be required before the locks could be opened to commerce. A board of engineers was convened to discuss the details of construction, and it indorsed all Major Handbury's plans. Former designs were used, with the exception of some modifications as experience had proved to be necessary, chief among these being the substitution of a dry stone wall for timber cribbing along the sides of the canal and of steel gates in place of those of wood. In 1890 a revised estimate of the work was submitted. The appropriations up to that time had been $1,880,000, and Major Handbury calculated that $1,745,000 more would be required, and experience proved this figure to be practically correct. An appropriation of $320,250 was made in 1892, with a provision for letting out the work by contract, and in November of that year Messrs. J. G. and I. N. Day secured the contract and at once began work.

The location of the Cascade locks is one to gladden the heart of any lover of the beauties of nature, as it is in the midst of the magnificent scenery for which the Columbia is famous. The great river breaks through the Cascade Mountains at this point. As one gazes at the rugged mountain peaks with their mantle of perpetual green on all sides of him, and downward to the mighty rushing waters at his feet, boiling and eddying in a way that recalls the rapids at Niagara, it forms a picture that will linger long in his memory.

When the finishing touches have been put upon the locks, in the way of beautifying the premises, the view will be improved, not marred, by man's handiwork, as there are no factories or other unsightly buildings to form a blemish on the scene.

The only other obstructions on the Columbia are the Dalles Rapids and the Celido Falls. These are to be overcome by a boat railway, twelve miles in length, the right of way for which has already been condemned, and, as the work can be completed in less than two years, the country beyond will not long be deprived of any advantages to be derived from the locks. The Dalles, the present limit of navigation, is 200 miles from the sea, but with the completion of the portage road an uninterrupted trip may be made by boat, from the Pacific, up the Columbia and the tributary Snake River for a distance of 500 miles, or, continuing up the Columbia, through Washington to the head of navigation in British Columbia, a point over 600 miles from the sea.

The Cascade locks constitute a work of which the country as well as those engaged in their construction may well be proud, and by many they are considered the largest in the world. A claim for this distinction is also made for the Soo locks, whose gates are 40 feet high, with a span of 100 feet. The span and height of the large gates at the Cascades are 56 feet and 90 feet respectively, thus being higher and narrower than those at the Soo, the claim of greater size being based on the fact that the area is considerably in excess of that of the rival gates. A factor which required careful consideration in designing these locks was the great variation in the height of the river, the difference between high and low water being 55 feet. At the Soo and many other locks the water varies only a few feet in height. This condition made it necessary to construct a series of three sets of gates, increasing in height from the lower entrance to the huge upper guard gate, only two sets being used at one time. When the river is low, the upper guard gates remain open continually and the lower sets are operated, and vice versa, when the water rises sufficiently to drown the lower gates, they are swung open and the work is done by means of the others.

The upper approach is formed by a fine wall of masonry extending from the guard gate in a long sweep of 1,200 feet. The bank back of it is riprapped in a substantial manner.

The center of interest is the great gates. Designed after long study, and, though so large, executed with all the nicety of clock making, these creations of steel, which are so well hung as to fit together with perfect accuracy, are truly fine specimens of what engineering skill can accomplish in this line. The steel is all of American manufacture, having been made by the Maryland Iron Works, at Sparrow's Point, Md., to whom the contractors give abundant measure of praise for the excellent quality as well as the accuracy of the work.

Like most steel gates, these form a perfect arc of a circle—a form not practical for those of wooden construction, as strength would have to be sacrificed to obtain the shape. The total weight is supported at all times by a pivot and anchor, exactly on the principle of the hinges of an old-fashioned garden gate. The pintle or pivot at the bottom, on which the gate swings, is of forged steel, hemispherical in shape, and is 9 inches in diameter. The upper hinge is made by a heavy collar forging, from which radiate six bolts, each 4½ inches in diameter and 22 feet long. These are embedded in the massive masonry for their whole length, and each terminates in an iron casting 2 feet square. It was necessary to make each of these bolts of sufficient strength to support the whole strain of the gate, for, as it opens or shuts, the pull is transferred from one radius to another, each in turn for a small part of the journey receiving the full weight.

Many gates are so constructed that, when the water presses upon a fraction of the area, the strain is distributed over the whole, but those of the Cascade locks differ from this, each girder taking the strain separately. Of course, with this system, the connecting surfaces, being so long, may not be absolutely straight, but the pressure is so distributed that any slight depression of one surface is met by a corresponding elevation on the opposite, and no leakage occurs.

Many people suppose that the gates, when shut, rest solidly upon the bed of the chamber, but, far from that being the case, there is an open space directly beneath. The contact which prevents the water from finding its way into the chamber is made in a different way. Extending along the bottom of the inner surface of the gates there is a depression which, when the gates close, fits against a series of castings bolted into the concrete of the floor. In these castings is embedded a long strip of heavy rubber. It is not calculated to have the pressure of the water on the gates transmitted in any great degree to this rubber, but it forms a connection between the two surfaces which is well nigh watertight. In many locks timber takes the place of this rubber surface. As the gates swing together, the surfaces connecting the two are steel bars extending the whole 90 feet of their height, and they meet with an accuracy that is amazing to anyone not accustomed to the exactness of engineering work. The different sets of gates are identical in design, though they vary greatly in size.

The masonry on all sides forms a striking illustration of what man can accomplish, stone fitting stone with perfect accuracy, and the whole built on lines in which not even an instrument can detect an error. Such work is very costly and has consumed the major part of the money spent on the locks. All the stone used in the construction of the locks was quarried on the spot or brought by scows from a point a few miles up the river. It is a basaltic lava, pleasing in appearance, and forming a building material eminently fitted for the purpose. It is estimated that 2,400,000 cubic feet of stone have been laid in this work.

The contract was not taken to complete the plant for a certain sum, but it was specified that the contractors were to be paid by the number of cubic yards of excavation, by the cubic feet of stone laid and pounds of iron used.

The lock chamber is 475 feet long by 90 feet wide—sufficiently large to accommodate several river boats at once. The bed is of concrete.

The main culvert which conducts the water to fill the chamber extends the whole length of the latter, being built in the wall, and is about 10 feet square—a passage of sufficiently ample dimensions to accommodate a team with a load of hay, and one which carries a tremendous quantity of water. Eleven filling culverts empty the contents of the main culvert into the chamber, each 3 × 5 feet in size. On the opposite side, the main culvert opens directly into the chamber, as the wall will not be completed till a future appropriation, though the present condition does not interfere with the operation of the locks. The total lift is 24 feet and about half an hour is required to put a boat through the locks. The gates can be opened and closed in one minute.

One of the most interesting things about the locks is the system of hydraulic engines which opens and shuts the gates, controls the valves and does all the work. In the mountains, 500 feet above, is a reservoir with a 10 inch pipe conducting the water to the engines This affords a pressure of 217 pounds to the square inch and effectually does away with a battery of boilers and with steam engines. Placed in pits in the masonry, the hydraulic engines occupy little space and perform the work in a perfectly satisfactory manner. There is an engine to each wing of each gate. The cylinder of the engines operating the large gates has a 13 foot stroke, and, with its diameter of 18 inches, affords a steady pull on the cables of about 55,000 pounds. The gates are opened and shut by a system of cables similar to that of an elevator, the principle being that a short stroke of the piston produces a long pull. The ratio in this case is one to four. The cables are 1¼ inches in diameter and are attached to the lower part of the gates. Those on the inside cross, as each engine opens its own gate and closes the opposite. Thus, for example, the south engine opens the south gate and closes the north gate. The piston rod extends from both ends of the cylinder and carries on each extremity a pair of wire rope sheaves. The reason for this arrangement of double piston rods and crossheads is simple. As the piston advances, the forward movement of the sheaves causes a pull on one side of a gate and the same motion of the rear sheaves of the opposite engine slacks off the cable on the other side of the same gate.

The valve which controls the admission of the water to each culvert has its exact counterpart in principle in the damper of an ordinary stove pipe, although it is so huge in size. It is supported by a 10 inch shaft and weighs 8 tons. The power to move it is derived from a separate hydraulic engine, with a 15 inch cylinder and 6 foot stroke, and is applied by means of a bell crank lever and long connecting rod. On each side are large hydraulic capstans designed to assist in moving vessels while in the canal.

Great credit is due to the engineers and contractors who have completed the Cascade locks for the high grade of work done and the harmonious way in which all have labored together. Major Handbury carries off the lion's share of the honor of having designed the improved plans, as well as having greatly accelerated the progress of the work. After his removal to the East, Major Post was put in charge and the completion was under the direction of Capt. Fiske. Lieutenant Harry Taylor, of the army, was the engineer detailed for the duty of seeing that the specifications were carried out to the letter. Messrs. J. G. and I. N. Day, the contractors, have executed the work with all possible celerity, having 900 men engaged for some time. A delay of several months was caused by the excessive high water of 1894, which also necessitated a heavy additional expense in guarding the work from great damage.

Like those at the Soo, these locks are operated by the government free of charge, under the direction of an army officer detailed for the service. Each vessel using the locks must fill in a blank furnished by the government, stating its tonnage, amount of freight, and number of passengers carried.

The amount of business which will be done by the locks is an interesting subject for the statistician, and, though many are the estimates advanced, there is as yet too much of the element of speculation about it to make a reliable report. The freight annually handled at one point on the upper river may be considered a valuable factor in making this calculation. The total incoming and outgoing freight at the Dalles, last year, was 53,450,000 pounds, besides 1,000 car loads of cattle and 10,000 sheep. With cheaper rates, adjacent counties will ship from here, and, considering that this is but one point on a river navigable for several hundred miles, we see that the total of the freight of this country is very large. Doubtless the railroads will still handle a large part of the business, but water transportation is always a most salutary regulator of freight rates, and everything consumed or produced in an area of probably 100,000 square miles will be affected by these locks, which open the great Columbia River to commerce. In particular will the vast quantity of wheat raised in Eastern Oregon and Washington feel the improved rates of transportation to the coast, whence it seeks a market in Europe. The people of the "Inland Empire" may well congratulate themselves on the completion of the Cascade locks.

A Mycological Club.

A mycological club has been formed in New York City. The object of this club is to bring together all those who are in any way interested in edible fungi, to study edible mushrooms and toadstools and those noxious and poisonous kinds that may be mistaken for them, and to disseminate all information concerning them, and to arouse a wider appreciation of a cheap food supply too often neglected in this country.

England has long considered mycology a profitable study and supports a number of flourishing societies. The Boston society was started in 1895, and its rapid growth encouraged the promoters of the New York society to start a like movement in New York. The members of the new society will make excursions in the parks of the city and the suburban districts, searching for different varieties of fungi. The specimens collected will be exhibited to the public and lectures will be given on them, some of the members explaining how to distinguish the poisonous from the edible variety. Lastly, it will show how to prepare them for the table. The society has at present rooms at 841 Fifth Avenue, New York City.

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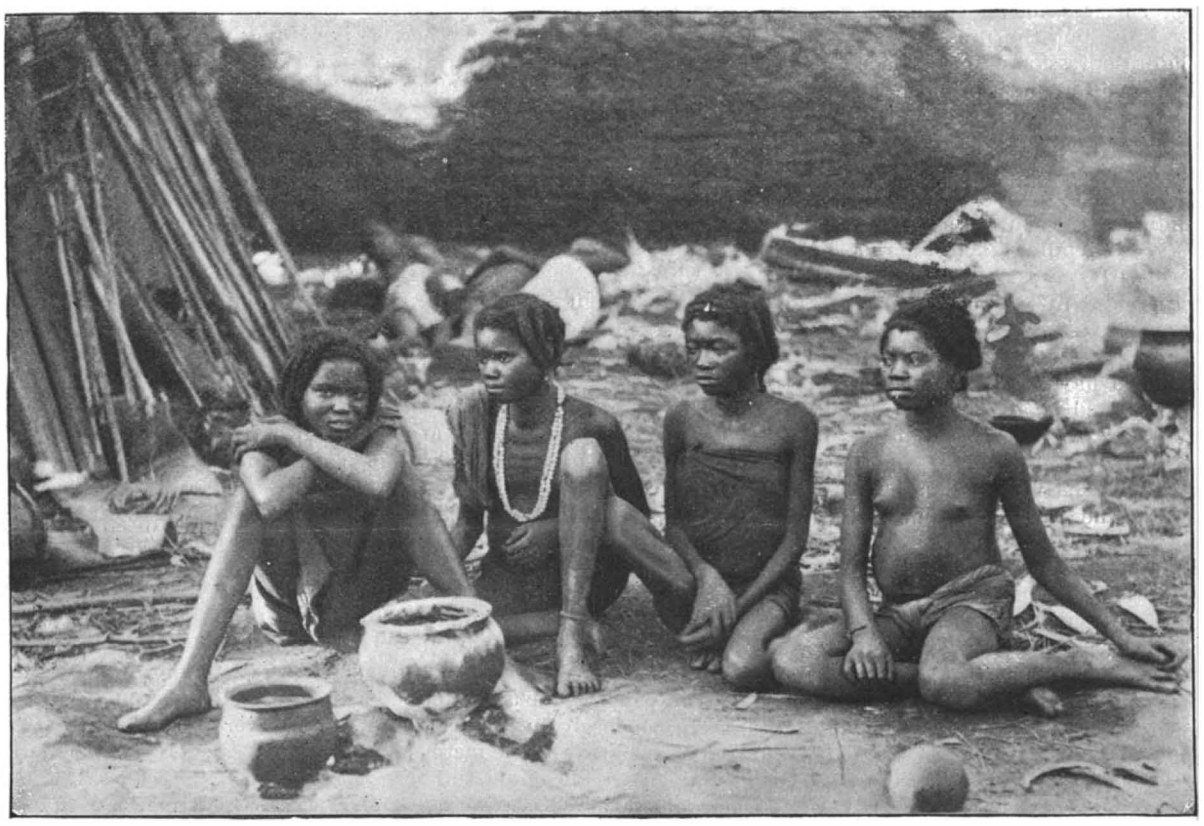
THE INTERNAL SLAVE TRADE OF AFRICA.

In a recent lecture before the American Geographical Society, Mr. Heli Chatelain made some very startling statements regarding the extent and horrors of the slave trade in Africa. The lecturer's long residence in the Dark Continent, his intimate knowledge of the country, its people, customs and languages, entitle him to speak with authority. He is ex-United States Commercial Agent at Loanda, West Africa; corresponding member of various geographical societies, and has made a name for himself also as the author of several native grammars and the translator of two of the Gospels into the native language of Angola.

The lecture, of which a digest is herewith presented, was copiously illustrated by stereopticon views. A few of these, which had been taken from life by himself and other travelers, are reproduced in the present article, and illustrate the nameless horrors of slavery.

Let no one suppose that the slave trade in Africa is a thing of the past. In this great continent, 5,000 miles long by 4,800 miles wide, which the European powers have recently partitioned among themselves, it still reigns supreme. "The open sore of the world," as Livingstone termed the internal and truly infernal slave trade of Africa, is still running as offensively as ever. Among 200,000,000 Africans, 50,000,000 are slaves. Only a few years ago the explorer, Cameron, estimated at 2,000,000 the number of victims claimed every year by the slave trade. "If I shut my eyes," said he, "I see the villages burning, I hear the shouts and mus-

THE INTERNAL SLAVE TRADE OF AFRICA—SLAVE GANGS OF FOUR IN CHAINS.



THE INTERNAL SLAVE TRADE OF AFRICA—YOUNG GIRL SLAVES IN A TRADER'S YARD AT LOANDA.

ketry of the murderers and the cries of their victims." If the estimate of the British and Foreign Anti-Slavery Society is correct (and it seems to be rather below the reality), 500,000 lives are at the present time sacrificed every year for the maintenance of African home slavery.

In the islands of Zanzibar and Pemba alone, which are entirely governed by Great Britain, 260,000 are held in bondage. For each slave that reaches the coast, eight or nine are said to perish on the way down and in the interior; so that the supply of 7,000 slaves annually smuggled into Zanzibar, and of 11,000 smuggled into Arabia, represents the murdering of some 60,000 in the regions whence the slaves are drawn.

From Zanzibar the slaves can legally be transferred to Pemba, whence it is easy to ship them to Arabia and Persia. Over 1,500 dhows are engaged in this business. From this example of slavery in two small islands one may form an idea of the enormity of the evil over the whole face of the Dark Continent.

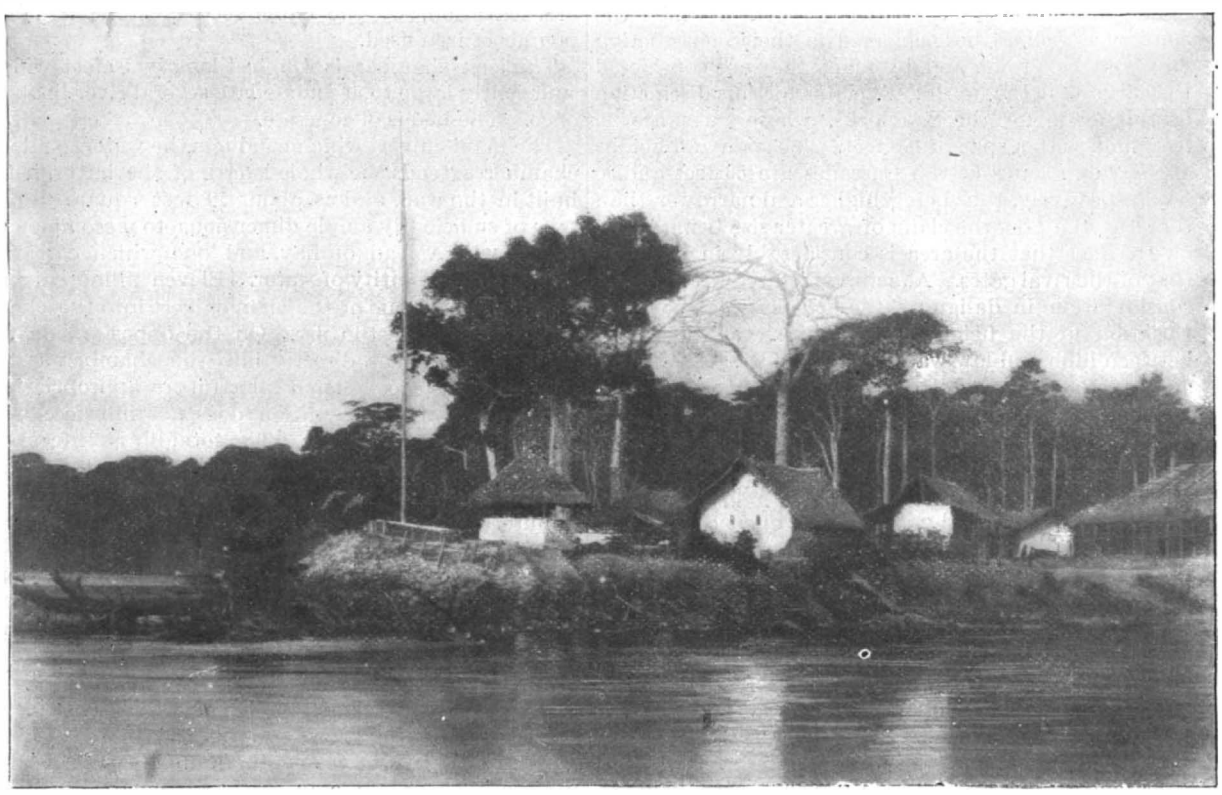
The lecturer said that it is a lamentable illusion to suppose that all the slave traders are Arabs. The Moslems in Africa are for the most part arch slavers, it is true, and their subjugation will mean a severe check to the slave trade, but it will not mean its final extinction. Slave trade has its source in slavery. The supply is created by the demand. Slavery is an essential element of African society. The parents sell their children; debtors and criminals are sold into slavery instead of being locked up in jail; girls are frequently sold to polygamists even before they are born; slaves are the regular currency over immense areas of the interior; they are the beasts of burden that bring the ivory, rubber and wax to the coast and take the European manufactures back to the interior; they are, too often, the porters of the caravans which European travelers lead into unexplored regions. The extinction of the slave trade implies a complete reconstruction on a Christian basis of the whole social order. It requires the co-operation of the political power, of missionary effort, and of special anti-slavery societies.

It is a fact that in Morocco slave-trading operations are being carried on under the protection of the American flag. Last July the British and Foreign Anti-Slavery Society called the attention of our government to the fact that Moroccan Jews, who, by the laws of Morocco, are not allowed to hold slaves, place themselves under the protection of the American flag in order to practice this business. Slave dealing and slave holding are legal under Mohammedan rule, and public sales of slaves take place to-day, even in Tangier, almost within sight of Gibraltar. In Sus and Terdant small children are sold and find ready purchasers, not only among the Moors, but equally among the Jews. In Tripoli the same practice prevails. In Egypt, although it is repressed by English officials, the slave trade is by no means extinct. On the west coast of the Red Sea a brisk slave trade is carried on with impunity. "The transport," says Mr. J. Theodore Bent, the explorer of Mashonaland, "is done in dhows from the Arabian coast, which come over to the coral reefs of the western side, ostensibly for pearl fishing. The many little harbors formed in the coral reefs offer every assistance to the Arab dhows, and the practice will continue until the reconquest of the Soudan is accomplished."

In the Eastern Soudan the Khalifa has a large number of "seribas" or armed stations, whence his men start on their raiding expeditions for the capture of slaves.

In Zanzibar and Pemba the plantation labor, the hard work in the harbors, the warehouses and the streets and the porterage of expeditions to interior Africa are all performed by slaves. Almost all these slaves are, as confessed by the British government, illegally held, because smuggled into the islands in spite of formal treaties. In Zanzibar women prisoners can be seen every day chained together in gangs of about seven and working under the supervision of a policeman armed with a lash. None of the facts brought out by the commissioner of the British Anti-Slavery Society has been denied by the English government. The reason given for inaction is the fear that a hasty reform would cause an Arab uprising. Lord Salisbury has, however, promised to abolish the legal status of slavery before the end of this year.

Fortunately the power of the East African Arabs is fairly broken. Tipoo Tib enjoys the fruits of his rapines at Zanzibar and has probably forever bid adieu to Kongo and Tanganyika. Rumaliza, whose name signifies "he who destroys utterly," after fighting unsuccessfully with the Belgians on the other side, and with the Germans on this side of Lake Tanganyika, escaped to Zanzibar. Nearly all the chiefs who have survived the recent campaigns carried on against them by the Congo State, by Germany, and by the British of Nyassa Land, are in subjection, and the only slave trading in Nyassa Land is that which is carried on by the native tribes among themselves, of whom the Angoni are the worst offenders. "The Angoni," says a missionary in Nyassa Land, "possess from 100,000 to 150,000 slaves. The sole possession of these poor creatures is a strip of goat or cat skin around their loins. They are kept in subjection by two species of terrorism.



THE INTERNAL SLAVE TRADE OF AFRICA—LUEBO AT THE HEAD OF STEAM NAVIGATION ON THE KASSAI RIVER.

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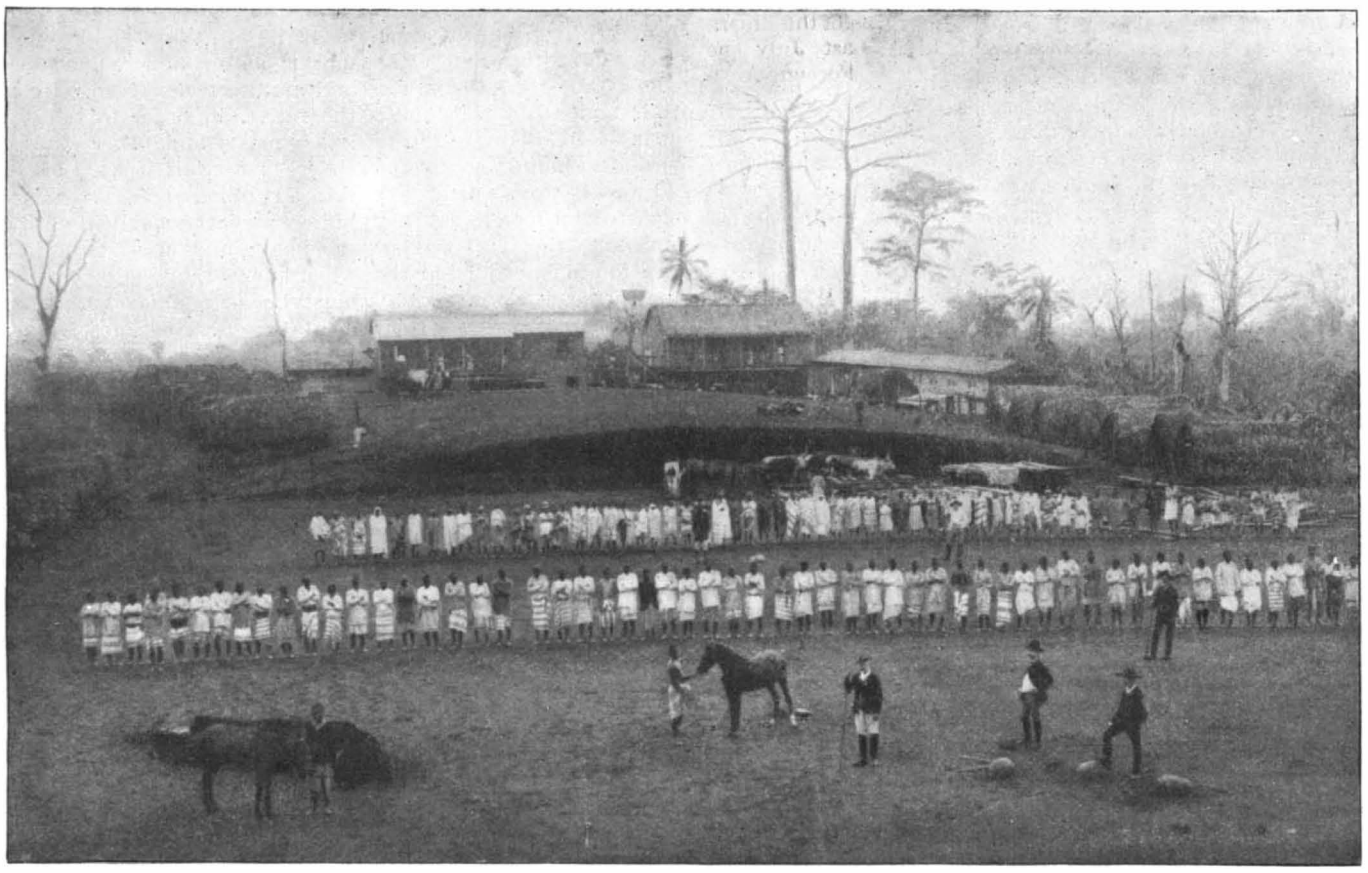
First is the spear, second is the poison ordeal, which is administered to the friends of a fugitive slave, sometimes to fifty persons at a time. In one village, the other day, eleven persons lay dead from this cause."

Slavery is legally abolished in all Portuguese colonies, yet the inhabitants of the islands of Sao Thomé and Principe are to all purposes plantation slaves. Of the Brass tribes in the Lower Niger district Sir John Kirk, Great Britain's special commissioner, officially reports: "They are a mixed race recruited largely by the purchase of slaves from the pagan cannibal tribes, chiefly the Ibo people, and by domestic slaves born in their families, the status of the child depending on that of the mother. Slaves are generally obtained when young, and cost on the average from $50 to $100 each. Higher up the Niger is the home of the semi-civilized and most enterprising Hausa people, 15,000,000 strong, all of whose country is included in the territory of the Royal Niger Company, and is under the guardianship of the Foreign Office in Downing Street." The best authority on Hausa Land, Rev. C. H. Robinson, states that "there are usually about 500 slaves on sale in the Kano market. Every town of any size possesses its slave market. The provinces of Bantshi and Adamawa contribute no less than 4,000 slaves per annum to the Sultan of Sokoto. This system," says the same authority, "brings upon the country nearly all the evils of perpetual civil war. As many as 1,000 slaves were brought into the town during my stay in Kano on a single occasion, as the result of one slave raiding expedition." They are used as currency and their total number in Hausa Land alone is estimated at 5,000,000.

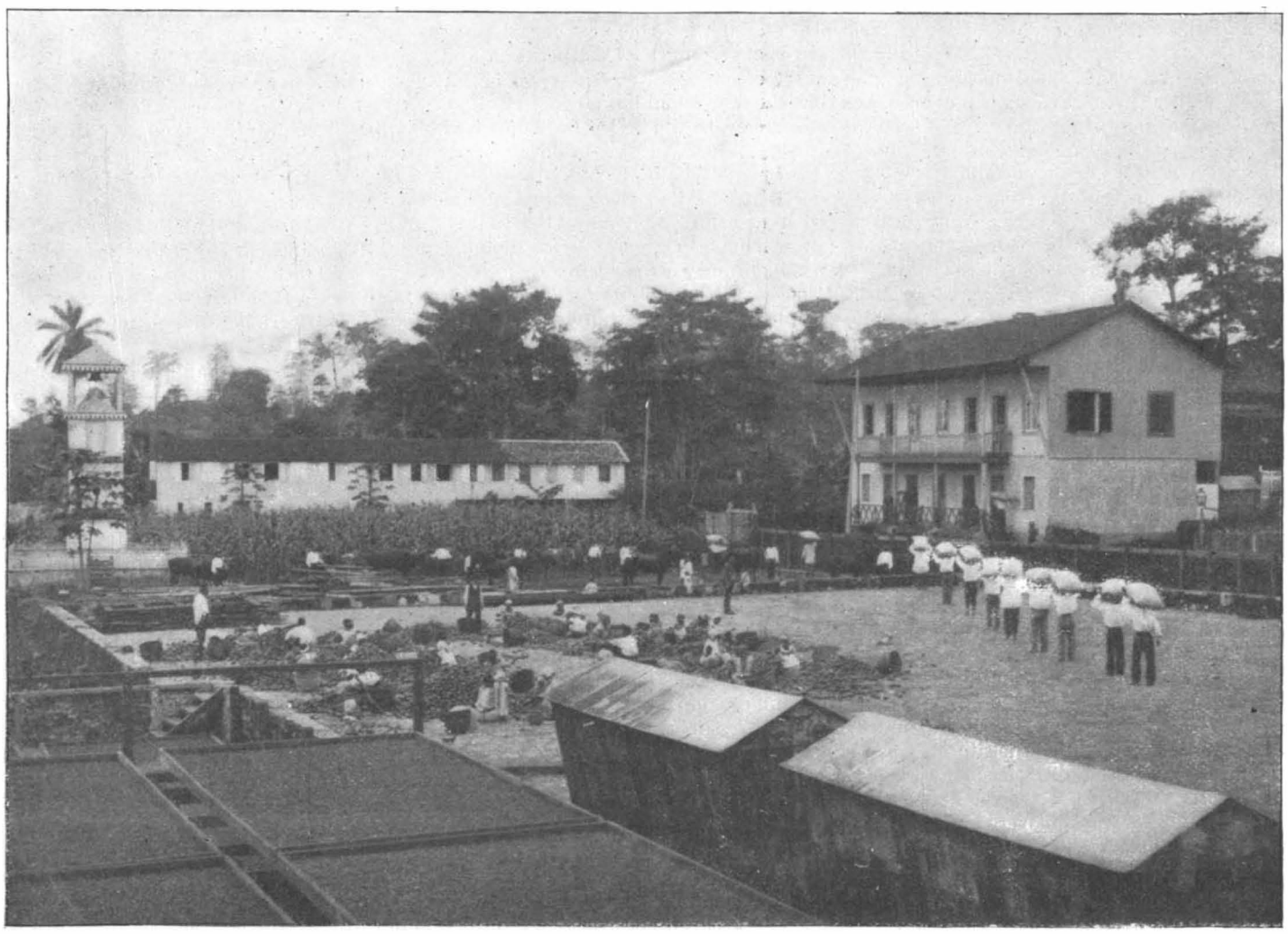


THE INTERNAL SLAVE TRADE OF AFRICA—PLANTATION SLAVES AND SLAVE QUARTERS ON THE ISLAND OF SAO THOMÉ.

On July 21, 1894, at Sierra Leone, the same writer entered in his diary the following note of a conversation with the acting governor: "The accounts he gave of the slave trade at the back of the colony were most discouraging. Until quite recently slave raiding had been going on within four days' march of Freetown. Farther inland he had passed for seven days at a time the burnt villages and country which had been desolated by the slave hunter." The above are only a few facts culled from the many which could be cited to prove that slavery and the slave trade exist to-day in almost every town and village inhabited by African natives.

On January 19, 1892, the President of the United States ratified a general act between the United States of America and the other powers for the suppression of the African slave trade. The ratification was deposited with the King of the Belgians on February 2, 1892; the act was proclaimed on April 2, 1892, and on the same day it took effect. It is known as the Brussels act of 1892.

Political power alone, however, would prove unable to eradicate the evil. It needs the co-operation of philanthropic societies, due to private initiative, which will supplement force by persuasion, and follow it up by education along agricultural and industrial as well as intellectual and moral lines. For this purpose most Protestant and Catholic nations of Europe have organized societies, raised money, and commenced effective work in Africa. America, which by its spirit and traditions ought to take the lead, has hitherto done practically nothing in this great work.



THE INTERNAL SLAVE TRADE OF AFRICA—COCOA PLANTATION ON THE ISLAND OF SAO THOMÉ.

The organization of what is known as a Philafrican Liberators' League was completed at the close of last November. Its board of directors includes many names of national reputation, among which may be mentioned the Hon. Charles P. Daly, Fred. R. Coudert, President Gilman of Johns Hopkins University, Senator John T. Morgan, Miss Frances E. Willard, Mr. Booker T. Washington, representing the colored South; and among the clergy, the Rev. Drs. Josiah Strong, L. T. Chamberlain, David H. Greer, David J. Burrell and W. H. P. Faunce, of this city. Ex-Postmaster General Thos. L. James is the treasurer. The plan of work outlined and matured by Mr. Chatelain contemplates the acquisition of grants of land sufficiently large to give scope for a village or town of moderate size. From this territory, the chief curses of Africa, namely, slavery, polygamy, witchcraft, rum and immoral white men, are to be rigorously excluded. In this free land, the location of which the league has chosen upon the high table land between Angola and Lake Nyassa, liberated slaves are to be settled and educated. The work of each station is to be divided into agricultural, industrial, educational and medical departments, under the direction of competent specialists. Such a settlement can be started for $10,000, and, after being fully equipped, can be maintained at a very small cost. Mr. Chatelain is making an urgent appeal for the necessary $10,000 to establish the first settlement and he hopes to take out the first expedition and establish the first colony during the spring of this year. The address of the league is 513 United Charities Building, New York.

An Invention Wanted.

Quite a number of managers are looking for, or experimenting on their own account, with a view of adopting some convenient device for carrying wheels on the outside of cars, says the Street Railway Review. This seems to be especially desired in those cities where there are long, steep hills with the riding territory at the top or bottom. We illustrated some months since the scheme of hooks on the outside of the cars at Butte, Montana. There the city is away up on the top of the mountain and the good wheel roads down in the valley. In San Francisco the order is reversed, with the choice riding streets on the high plateau, to reach which the wheelman has to push his vehicle up long, steep hills. General Manager Vining is looking for a good, simple device to take care of the bicycles. Here's a chance for some ambitious inventor.

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Correspondence.

A Machine Wanted.

To the Editor of the SCIENTIFIC AMERICAN:

As you are doubtless aware, there is a large export of ginger from Jamaica, amounting in 1896 to over £50,000, and the trade is capable of considerable expansion. The cleaning and preparing of the ginger for the market, as now performed by hand, is a slow, primitive, tedious and wasteful process. After the roots are dug they are washed and the outer skin removed by means of a small, sharp knife resembling the blade of a penknife. As you will see by the specimen of green ginger (sent by sample post), the roots are very irregularly shaped and the present system involves the loss of a large percentage of the root which is broken off or cut away in removing the skin. The market value of ginger is much enhanced by its having undergone the process of peeling, and better prices are obtained for the larger specimens. An expert can peel by hand about 1 cwt. of uncured ginger in the course of a working day, for which he is paid 60 cents. My object in writing is to invite the attention of your readers who may consider the matter of sufficient importance to warrant the adaptation or invention of some machine for peeling the ginger more economically, expeditiously and effectively than at present. If such a machine were brought forward, I feel sure it would be well received, not only here but in other ginger-producing countries.

GEORGE A. DOUET.

Jamaica Agricultural Society,
Kingston, Jamaica, W. I.

Discovery of Aboriginal Remains near Springfield, Mass.

BY HARRY ANDREW WRIGHT.

An interesting discovery of Indian remains has just been made at Springfield, Mass., by the exploration of the cemetery connected with an aboriginal village and fort. Two or three years ago the village site was thoroughly explored according to scientific methods, it probably being the first work of the kind ever attempted in the Connecticut Valley.

In these explorations the entire field is first blocked out with stakes and strings to facilitate drawing plans of the excavations. A trench is then dug along the first block, and keeping a vertical wall in advance, the block is sliced down, inch by inch. As each block is completed, ground plans are made indicating the location of every article found. In no case are excavations made from the surface. The moment this is done all is confusion and the sequence of materials is lost. The method is expensive in proportion, but only such methods give full results. Unless this work is done thoroughly it is of no value whatever, as isolated objects without record of source or association are of no scientific importance, however interesting they may be as curiosities.

The palisaded fort of the Agawanis stood on Long Hill, on a jutting bluff which gives a view for miles and miles in either direction along the valley. The ground is of a peculiar formation, being cut through with deep gullies, between which narrow headlands lie, and on one of these headlands was the village and fort. According to tradition, this fort was occupied by the Indians of Agawan as late as October 5, 1675. On the evening of that date, having burned the little town of Springfield, they left the valley, never to return.

As the ground had received much natural deposit in the two hundred years since its occupancy, the first work was to remove about a foot of soil from the surface, exposing the original surface to view. Here the ground was found to be laid out in regular blocks about eight feet square. Within each square a camp fire had been built at some remote period, the gray wood ashes being packed into pits some eight feet in circumference and two or three feet deep. So hard were the ashes in some of these pits that it was impossible to dig into them, and often the entire contents had to be removed before being broken up. Within these hard masses were found the remains of many a feast. Bears' jaws with every tooth perfect, deer antlers and human ribs were found in perfect condition, the Indians believing that unless the bones from the meat were preserved and burned, all the game would leave the country. The supposition is that the location of each one of these ash pits marks the site of a wigwam, inside of which a fire was built, the smoke passing out through the roof. The site of ten rows of lodges and two large council houses was uncovered.

The existence of so large a village would lead one to suspect the near presence of a spring of water, and, after much searching, the village water supply was located. It seems that years ago a bank caved in, covering the mouth of the spring, which caused the water to flow under ground and form a marsh at the foot of the hill. By digging away the bank the opening was uncovered and the water again gushed out as it did in the old Indian days. From the spring a patch, screened by a close hedge, followed the brook to the fish weirs and canal landing by the river side.

Near one of these houses or wigwam sites the first skeleton was found. It was the custom to bury the dead near the house, after preparing the warm body by tying it in a contracted position, with the knees drawn up to the chin, and the neck, thighs and legs flexed. When cold and stiff it was put into the temporary grave in the village. Once a year all of these bodies were exhumed and with great religious ceremony given a final resting place in the permanent burying ground.

The explorers expected to find the permanent cemetery on the next bluff south of the fort, and much fruitless searching was made at the time the village was explored. But not until last month was it found, and on the second bluff south. Here, about eighteen inches below the surface, the whole ground was covered with charcoal from the old watch fires, which were kept burning to warm the departed spirit on its journey to the happy hunting grounds. As the bluff was cut away, thirteen skeletons were found embedded in the dry sand, like raisins in the slicing away of a cake. Each was headed to the south, the region where their god was supposed to dwell, facing expectantly to the east, from which direction the Indian messiah was to appear. The bodies were lying on the right shoulder; the right hand was under the cheek; the left lay across the breast, and the knees of each were drawn up under the chin. As the workmen cut away the ground from south to north, the bones grew older and more frail, until finally it was only possible to detect in the clear sand the discoloration produced by the mould of the crumbled skeleton. The charcoal, quite firm at first, grew gradually more soft, until it was only possible to see a line of black beneath the surface mould.

Of the thirteen perfect skulls, three were of abnormal growth, having an extra bone, the epactal in the back. This is somewhat common in animals, but rare in human beings, and is therefore of much interest to evolutionists, as showing the low order of the race. Several are those of very aged persons, for there are but four or five teeth, and the jaw bones are worn perfectly smooth where the others once were. Nearly all show the great development of the lower, back part of the skull where the animal instincts are delineated.

Contrary to expectation, no relics were found in the graves. A few flint chips and a rough stone ax were lying near the surface, and in the charcoal were a clay cup and two metal spoons. These, with a few Dutch "fairy pipes," brought by early traders from New York, were the only articles found in the cemetery.

Casting Copper Pure.

The current issue of the Electrical Review contains the announcement of a discovery in the art of casting copper. Copper is ordinarily cast by the use of alloys. It is stated that the new metal, which is known as M. B. copper, is cast pure. Foundrymen have heretofore considered this an impossibility.

It is also stated that the new metal possesses an additional tensile strength of 33⅓ per cent, and that a much higher percentage of elasticity has been developed, and that the new metal has a conductivity of 95 per cent as compared with the best rolled copper. This will cause distinct changes in the building of dynamos, motors, railway and telegraphic apparatus, because the new copper is believed to carry the same amount of current with one-third the amount of metal. Wire made of it will have a greater strength and conductivity than the ordinary copper wire.

Mr. Edison says he accounts for the evident change in the atomic structure of the metal by the theory that the shape of the crystals has been altered, so that their lines are parallel, and that the molecules are thus brought closer together and into more intimate contact with each other. It is understood that Mr. Edison is interested in the development of this metal, and that it will be manufactured under his supervision at his Menlo Park works.

Electro Capillary Light.

In a contribution to Wiedemann's Annalen, No. 12, abstracted in the London Electrician, Herr O. Schutt, of Jena, describes a new electric discharge phenomenon, which he terms electro capillary light. When the discharge of an induction coil is sent through a narrow capillary tube of about 0·05 mm. in diameter, provided with aluminum or copper electrodes and filled with air under ordinary pressures, an intense luminosity of the tread of air is obtained—a luminosity which is intrinsically far superior to that of the arc, and would form an exceedingly powerful source of light if it could be made continuous. The narrow capillaries deteriorated rapidly, roughening inside, and were blown into a series of spherical enlargements. Wider tubes gave less light, but were much more permanent. At the same time the bright lines in the continuous spectrum in the original light became more prominent. At pressures above one atmosphere the phenomena were nearly the same, but the sparks passed with greater difficulty. At low pressures the light became less intense, the continuous spectrum faded, and the bright lines shone out more distinctly. The kind of glass is immaterial. It is stated that the tubes may be made 20 centimeters long and make splendid line sources.

ABOUT MERRIMAC SHIP BUILDING.

BY HORACE C. HOVEY.

The origin and decline of the art of ship building should interest others besides seafaring men. I use the word "art" advisedly. A veteran ship carpenter put the case thus to me one day. If a man paints on canvas, he is an artist; if he makes verses, he is a poet; if he contrives machinery, he is an inventor; if he builds meeting houses, he is an architect; but if he builds ships, he is only a mechanic. Yet the master ship builder must be artist, poet, inventor and architect combined. He must know the trees of the forest, in order to select timber for keels, ribs, knees, masts and other parts of his ships. He must choose materials that can endure soaking in salt water, rubbing against wharves, and the concussion of billows; reject what will not bear Arctic cold or tropical heat; and use what will not be split or shaken when pierced by bolts or wrenched by storms. He must be as familiar with natural laws and experimental results as most inventors; must have as good taste concerning form and color as an artist, and exercise his imagination as much as an average poet, in order to shape the graceful outlines, bounding curves, and due proportions of his vessel from truck to keelson, so as to compel the admiration of lovers of the beautiful, without sacrificing strength or utility. I have not used his exact words, but these were his ideas.

The first ship of the English navy was built by command of Henry VII, at a cost of £14,000, and was named the Great Harry. An official inventory made at the death of Henry VIII shows that the gross measurement of the English fleets, in A. D. 1547, was but 12,455 tons, and that the average size of the vessels in the navy was less than 240 tons each.

The first vessel built in New England was the Virginia, of only thirty tons burden, launched by the colonists at the mouth of the Kennebec River, in Maine, A. D. 1607, thirteen years before the arrival of the Mayflower at Plymouth, Mass. Ten years before the coming of the Mayflower, Lord Delaware saw in the roads at Point Comfort, Va., four vessels, the Virginia, the Discovery, the Deliverance, and the Patience. Small as was the Virginia, it was stanch enough to make several successful voyages across the Atlantic, and merits more fame than it has received.

Six shipwrights were sent over to New England, in 1629, by the Massachusetts Bay Company, the chief of whom was Robert Moulton. Their first vessel, mainly built of locust, owned by Governor Winthrop, and named by him The Blessing of the Bay, was launched July 4, 1631, at Medford, on the Mystic River. Ship building was begun at Salem, in 1635, by Richard Hollingsworth, with aid and encouragement from the Rev. Hugh Peters; at Gloucester, in 1643, by William Stevens; at Ipswich, in 1668, probably by Daniel Hovey, whose wharf was built that year, and which may still be seen at low tide; and at what is now Newburyport, in 1680, by the recorded vote of the old town of Newbury, granting land for that purpose to Benjamin Rolfe and others, at a point near what was then known as "Watts, His Cellar." Possibly Duncan Stewart built vessels before this at Thorlay's Bridge, on the Parker River. Ship building was also carried on along the Merrimac at Bradford, Haverhill, Amesbury, Salisbury and other localities. From Massachusetts Archives, Vol. VII (unprinted), "there were 130 vessels built on the Merrimac River from the year 1681 to 1714, of which over 100 were built at Newbury." The first in this list is the Samuel and David, of 100 tons. A number of them were built for London owners. A rude old painting may be seen in the public library of Newburyport, of a ship on the stocks at Moggridge's yard with Indians and negro slaves at work.

Among famous shipwrights of Newburyport may be mentioned Ralph Cross, and his sons, who built many vessels, including the frigates Hancock, Boston and Protector. Ralph Cross, Jr., was made a brigadier general during the revolutionary war. In 1775, Col. Benedict Arnold embarked a regiment of 1,100 men on ten vessels, and sailed from the Merrimac on an expedition against Quebec. In August of that same year the first privateer fitted out within the limits of the thirteen colonies sailed from Newburyport. It was owned by Mr. Nathaniel Tracy of that place, whose ships, as it appears from a memorial to Congress, "captured 120 vessels that were sold for 3,950,000 specie dollars, and with these prizes were taken 2,225 prisoners of war." The history of our privateering has never been fully written up, but this shows what was done by a single patriotic merchant and shipowner. How much more was done we have no means of definitely knowing. But the melancholy side of the record is that, besides those that went forth and returned again, 22 vessels, with crews numbering 1,000 men, sailed and never returned. For many years after the war every vessel leaving American ports was required to be fully equipped with guns, even though sailing on a peaceful errand. Hence, in mentioning the launching of ships designed for the East India trade, etc., it was customary always to state how many guns were carried. Newburyport vessels

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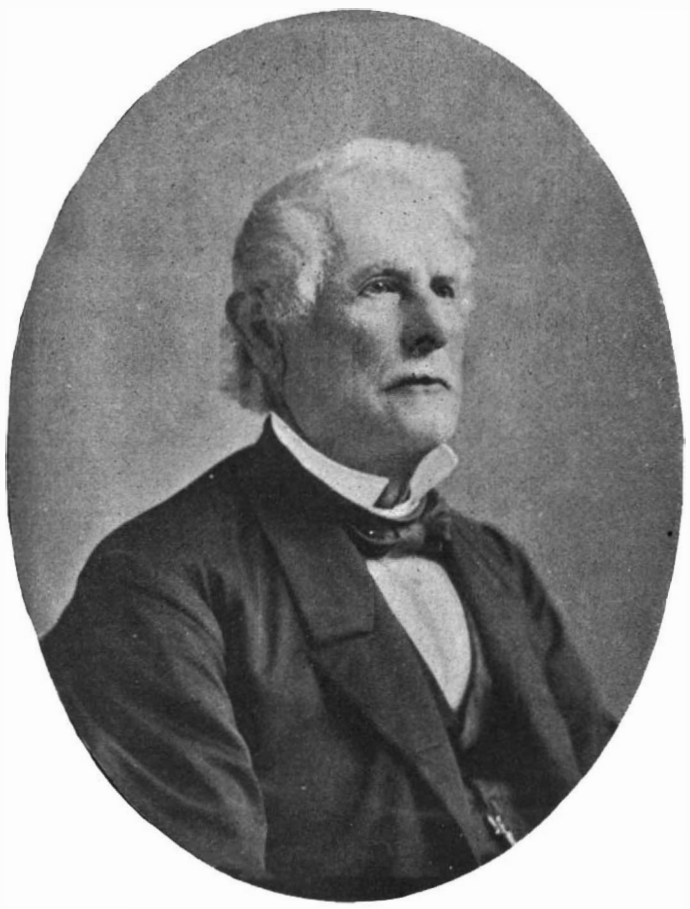
often carried costly cargoes and had to be protected. The first blow given to American commerce was the act of Congress (1805) forbidding armed vessels to leave the United States without a special permit, under penalty of forfeiture. The "Embargo Act" of 1807 was the next heavy blow, but prosperity returned on its repeal in 1809. The Wasp, launched from Merrill's shipyard, in 1814, captured thirteen English merchant vessels in seven months, when she was sunk by a British frigate. The first ship that sailed from the United States after peace was declared between the United States and Great Britain, in 1815, was the Indus, of Newburyport.

It is interesting to note the steps of progress from the tiny Virginia, of 30 tons, built in 1607, up to the mighty warships and merchantmen, of from 500 to 1,500 tons and upward, The steamers Ontario and Erie, built by George W. Jackman, Jr., were of about 3,000 tons burden each. But the largest merchant ship ever launched on these waters was the Daniel I. Tenney, registering 1,687 tons, built by the late John Currier, Jr. Among other large ships built here were the Dreadnaught, 1,414 tons, the Farragut, 1,549 tons, the Radiant, 1,608 tons, the Racer, 1,669 tons, besides sixty others of over 1,000 tons each.

For many of the foregoing facts we are indebted to Mr. John J. Currier, the son of the veteran shipbuilder mentioned above, who gave an address on the subject some years ago, and has also just published a substantial volume of 729 pages, entitled "Ould Newbury, Historical and Biographical," a work full of valuable information as to the ancient ferries, bridges, wharves, docks and shipyards, as well as other features of the history of this seagirt town. The book is embellished by numerous cuts, one, the portrait, being kindly loaned to us. It introduces us to the famous old shipbuilder himself. John Currier, Jr., who laid out this shipyard in 1833 and occupied it for fifty years, was the seventh in a direct line of descent from Richard Currier, one of the founders of Salisbury, Mass. He was born April 14, 1802, and died September 2, 1887; a man of integrity and honored with various offices municipal and ecclesiastical. During his long life he built and launched ninety-eight ships, brigs and other large vessels, which is probably more than was ever done in that line by any other American. In April, 1883, he launched the Mary L. Cushing, owned by Mr. John N. Cushing, which was the last merchant ship built in Massachusetts. Mr. J. J. Currier has made a curiously interesting and authentic list of all the ships, barks, brigs, brigantines, schooners and other seagoing vessels built in the district of Newburyport, from the organization of the United States government down to 1877, with the class, name, tonnage and ownership of each vessel, and stating when and by whom it was built. By my actual count I find thus catalogued 2,115 vessels, not including many more that were built here on contract and then sent, as was frequently done, to other ports to be documented; nor does it include the hundreds of fishing boats, yachts and other boats built here and of which no record has been made.

The decline in what may properly be called American commerce; the rapid disappearance of the forests of oak, pine and other kinds suitable for ship timber; together with the gradual substitution of steamers for sailing vessels, are the main causes that have practically destroyed what was once one of our proudest industries. Occasionally barges, sloops and smaller vessels are built along the Merrimac; but the era of ship building is ended, so far at least as these waters are concerned. The business was extinct twenty years ago in Salem, Gloucester, Ipswich, Rowley, Salisbury and Haverhill; and although kept alive for a few years longer in Newburyport, it is now decayed, and it will henceforth be known only in history. But it certainly should thus be known. The nation that justly honors its statesmen, warriors, literary men, architects and inventors ought to keep a place amid its archives for men like the Woodwells, Moggridges, Carrs, Crosses, Curriers, Gerrishes, Jackmans, Merrills, Hacketts, Mansons, and others, who, during a period spanning more than two centuries, manned the busiest shipyards on the continent, gave employment to many hundreds of skilled artisans, launched more than 2,000 seagoing vessels, with an aggregate tonnage of fully 400,000 tons. We are indebted to Mr. Otis P. Gould, of Newburyport, for the accompanying illustrations of the old shipyard and launch, made from his photographs. Most of those forty shipyards of the Merrimac and vicinity have been absorbed by other and more prosaic industries. A few only remain, unoccupied and in ruins.



JOHN J. CURRIER JR.

AN OLD NEWBURYPORT SHIPYARD.

A LAUNCH IN A NEWBURYPORT SHIPYARD.

A Brick Country Road.

The first brick country road laid in the United States has been put down in Monmouth Township, Warren County, Ill., says the Boston Transcript. The road is the culmination of a series of experiments in road building, and though it is regarded as more or less on probation, the utmost confidence in its success is expressed. When hard road building began in the township, four years ago, it was decided to expend the money on hand in an experimental way. Monmouth Township had long been a sufferer from bad roads. In winter the town had often been completely blockaded by mud too deep for wagons. Even within the town itself the streets were so poor that at times the "bus" lines were obliged to suspend business, and mail and baggage were carried to the railway station on wheelbarrows. The manner in which the roadway was laid is described as follows: The ground was prepared for it by grading and being allowed to stand for two months. It was treated to an occasional scraping, so that it would pack evenly, and when the contractors were ready to lay brick it was as hard and even as a floor. The first thing was setting the curbing. This was made by 2 inch × 6 inch oak plank, set 7 feet apart, and held by oak stakes 18 inches long, and put down every 4 feet. Inside this was put a 5 foot bed of sand. This was evened up, and the single course of No. 1 paving brick was put down. They were set on edge, and make a fine roadbed. Outside of the curb 2 feet of crushed rock was laid, graded up to make an easy approach. This makes a road 11 feet wide. The earth on each side was graded and worked, making it all 40 feet wide, and affording tracks on each side for use in dry weather. The average cost of the stone roads has been 70 cents per foot. The brick road cost $2,600 for 3,000 feet, or about 90 cents a running foot.

Great St. Bernard Avalanche.

The left wing of the great monastery of St. Bernard has been demolished by an avalanche, says a dispatch from Berne, dated March 1, 1897. Fortunately no lives were lost, nor was anyone seriously injured, but the monks occupying the monastery were in serious danger for some time before their safety was assured.

When the great masses of snow and ice descended upon the building, the occupants took refuge in the part of the building which remained intact, and from there were able to dig a tunnel under the snow, through which they crawled. Most of them were severely frostbitten.

MOTOR fire engines are to be tried in Paris, and horseless carriages are now admitted to the Bois du Boulogne.

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RECENTLY PATENTED INVENTIONS.

Engineering.

PROPULSION OF VESSELS.—John L. Helmolt, New York City. According to this improvement side paddles of finlike construction are located near the stern and near the stem of the vessel at each side, the paddles having a hinged connection with a sliding support, and each set being adapted to move to and from the other set, the forward set making a stroke against the water while the rear set moves forward, folded close against the sides of the vessel, and vice versa, the blades thus operating alternately to propel the vessel. Means are also provided for reversing the action of the paddles, to move the vessel backward, and the propelling mechanisms are equally balanced at each side of the vessel's hull, it being practicable to turn the vessel on its center.

Railway Appliances.

REFRIGERATOR CAR.—Charles S. Hardy, San Diego, Cal. This invention is for an improvement in cars provided with folding ice receptacles, and covers better means of packing the folding parts of the ice receptacle and improved spatter devices for the drain flue. The ice receptacle is composed of hinged sections, and is made water and air tight at all points except where openings are left for inlet and discharge, and the partition at the lower end forming the drain flue has rubber or other flexible material at its upper or inlet end, so arranged that the floor of the ice receptacle will normally seal itself to the drain flue by its own weight.

Electrical.

VOLTMETER. — Paul Brandt, Berlin, Germany. In order to avoid errors of voltmeters due to the remanent magnetism of the iron ore actuated by the solenoid, this inventor substitutes for the solid iron core hitherto used a sleeve of soft iron containing a bundle or cluster of wires, causing a mutual induction between the sleeve and the cluster of wires whereby the remanent magnetism of the sleeve is completely neutralized. The soft iron sleeve, containing its bundle or cluster of wires, is actuated in the usual manner, being drawn into the spool or bobbin of the solenoid and suitably connected to an index or pointer.

Miscellaneous.

NASAL EXPANDER.—George B. Farmer, Perth, Canada. A spring yoke carrying on its free ends suction cups is, according to this invention, adapted to be readily inserted and applied to the nose, to properly expand the nasal wings and improve the passages for air inhaled to insure better breathing. Each of the cups has a hard center and annular flexible rim adapted to gently but positively engage the inner surfaces of the nasal wings.

MOVABLE TOY DEVICE.—Axel L. Sjoberg, Union Hill, N. J. To impart a rapid or slow movement to toys or similar articles, this invention provides a device which may be contained in the article or in a casing forming a portion of the article. A counterbalanced winding shaft is journaled in a frame and a spring tension device is secured at one end to one side of the movable object, a guide at the opposite side of the movable object engaging a cord having one end connected with the winding shaft and the other end connected with the spring tension device. The winding of the device is accomplished by the motion of the article.

BREAST FORM.—George M. McCleary, McKeesport, Pa. This is a pneumatic form with convexed outer faces and provided with non-elastic shaping bands holding the form close to the body. Shoulder straps and a girth are also provided, the latter having elastic sections, and being united at the back by a lacing and at the front by a clasp.

Designs.

THILL COUPLING PLATE.—Charles T. Redfield, Glen Haven, N. Y. This plate has a main portion slightly bowed at the middle, and at one end a wing at an angle and terminating in a notched flange, while at the opposite end is a shorter wing, also notched.

FLOWER HOLDER.—Stephen M. Griswold, Brooklyn, N. Y. This holder consists of twin loops, side by side, made of one piece of metal, a pin being pendant from one of the loops.

INCANDESCENT LAMP BULB. — Lawrence H. Dolan, Alexandria, Ind. This is a six-sided pear-shaped bulb, whose surface is covered with diamond-shaped facets.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A MANUAL OF PHOTO ENGRAVING, CONTAINING PRACTICAL INSTRUCTIONS FOR PRODUCING PHOTO ENGRAVED PLATES IN RELIEF AND HALF TONE. By H. Jenkins. Chicago, Ill.: The Inland Printer. Pp. 129. Price $2.

A very practical book, beautifully printed, containing many illustrations of various styles of half tone work, the frontispiece being especially rich, representing the perfection of tricolor work in a picture of a goldfinch bird, the red breast, blue head, and intermediate colors coming out most brilliantly. Preceding this page are pictures of the bird in yellow, a pink red, blue and a darker red, which, when superimposed over each other, give the remarkable multicolored picture. There are directions for preparing the plates and their treatment, illustrations of the apparatus used and examples of different kinds of screen plates and diaphragms shown. It is a book easily understood, being based apparently on the results of actual experience, which is systematically classified and explained. It should prove a valuable aid to those desiring to be guided rightly in learning the elementary and practical points of the half tone process.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

Simple Motor No. 641. $6. M. F. M., Sturgis, Mich.

High grade well drills. Loomis Co., Tiffin, Ohio.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

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Notes & Queries

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7122) J. C. H. says: Supposing a gas jet in a dwelling house is left open and gas escapes at the rate of five feet an hour. Would it be reduced by igniting the same? That is, would it lessen the pressure or speed of the gas, in passing the cock at the jet? If so, how much? A. The tendency of lighting would be to increase the flow by expanding by heat the aperture in the tip.

(7123) J. W. asks: Will you please inform me in the SCIENTIFIC AMERICAN how camphorated oil is made? Also, what book can you recommend on pharmaceutical preparations? A. Camphorated oil is prepared by dissolving 1 ounce avoirdupois of camphor in 42 ounces avoirdupois of cotton seed oil, or dissolve 1 ounce avoirdupois of camphor in 4 fluid ounces of olive oil. We can supply the following books on pharmaceutical preparations: "The Era Formulary," 5,000 formulas, price $5. Beasley's "Pocket Formulary," price $2.25. Griffith's "Universal Formulary," price $5.50. "The Art of Compounding. A Reference Book for Pharmacists at the Prescription Counter," by Scoville, price $3 post paid.

(7124) C. H. W. asks: In a permanent magnet, there being a positive and a negative pole, will the negative pole repel the same object that the positive pole will attract? If so, is the field of repulsion of the negative pole of the same size and of the same inverse intensity as that of the positive pole? A. We answer the first query affirmatively. But the poles may vary considerably as regards the field of force in their vicinity. In other words, the polarization may be unsymmetrical.

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Programme.

HOME ENTERTAINMENT.

Part First.

1. PIANO SOLO, - Princess Bonnie Waltz
2. SONG—Tenor Solo, - Tramp, Tramp, Tramp
   By GEO. J. GASKIN.
3. BANJO SOLO, - - - - Titus March
4. SONG—Baritone Solo, - Starlight, Starbright
   By J. W. MYERS.
5. RECITATION, - Imitation of a Street Fakir
   By GEO. GRAHAM.
6. MALE QUARTETTE—Medley, - Mary Ann
7. SONG—Plantation Shout, Bye, Bye, Ma Honey
   By BILLY GOLDEN.
8. CORNET DUET, - - Short and Sweet
9. SONG, - - - - - La Marseillaise
   By SIGNOR GIANNINI.

Part Second.

10. BANJO SOLO, - Medley of Jigs and Reels
11. SONG—Tenor Solo, - Down in Poverty Row
    By GEO. J. GASKIN.
12. MALE QUARTETTE—Negro Song, Hear dem Bells
13. RECITATION—Poem by Eugene Field, Departure
14. DRUM AND FIFE (Descriptive), Spirit of '76
15. SONG—Baritone Solo, I Want Yer, Ma Honey
    By DAN W. QUINN.
16. RECITATION, - - Side Show Orator
    By GEO. GRAHAM.
17. SONG - (M. Farkoa's Great Success, French Laughing Song)
18. SONG—Baritone Solo, Say Au Revoir, But Not Good-bye
    By J. W. MYERS.

You will find our number for each selection in the list of our Records.

THESE people are certainly enjoying themselves, and no wonder, for they are listening to one of the most varied entertainments ever given in a private parlor. They were first, as you will perceive by the accompanying programme, entertained by a piano solo. They then listened to a popular and patriotic song. The next selection was a banjo solo, and after that a song by the baritone, J. W. Myers, "Starlight, Starbright;" then a recitation, "The Imitation of a Street Fakir." This was followed by a male quartette. Then came the very popular and famous Billy Golden with his plantation song, "Bye, Bye, Ma Honey;" following that a cornet duet, and then the French national song, "La Marseillaise," by Signor F. A. Giannini.

We have introduced in this advertisement the whole programme as rendered at this evening's "Home Entertainment;" each selection was a reproduction of the original. You listen to the quality and strains of the cornet; you absolutely hear the picking of the banjo, while the quartette singing and the solo singing are the natural reproductions of the real artists.

So true to life are these reproductions that if you were to come into the hall and see the people gathered together and yet not know that the evening's entertainment was given by a reproducing or, as it is perhaps better known, a talking machine, you would really never know it unless you had a chance to enter the room.

This special talking machine, the **Berliner Gramophone**, is the newest and the best. Its results are better than those of the regular $100 talking machines. We have made this result possible because of the discovery of a new way to record sound. It is recorded upon a flat disk and finally placed upon hard rubber, which makes it indestructible, very easy to handle, and, for the first time, thoroughly adapted for family use. These disks cost 60 cents singly, or $6 per dozen, and as the variety is almost unlimited, you can have a never failing source of pleasure and entertainment. Great men and great artists will be recorded, and you will thus be able to hear, in your own home, people of national and international reputation.

There is no musical instrument that the **Gramophone** does not reproduce. This spring motor machine, which runs by clockwork, we sell for $25, express prepaid to any point east of the Rocky Mountains. To points beyond we allow Denver express rates. Two records are included with each machine.

We guarantee **Perfect Satisfaction**, and will return your money, less express charges, if it is not satisfactory. It winds easily, weighs only fifteen pounds, and has the great advantage of being always ready for use, because its power is within itself.

We have two other styles for $10 and $15; the $10 machine is run by hand, and is furnished with ear tubes for two people to hear. The $15 machine is also run by hand, but is supplied with a governor, so that the speed is regulated, and after it is turned as fast as necessary cannot be turned any faster. This makes the hand machine sure to give you a good reproduction, even in the hands of a novice.

These two styles—the $10 and $15 machines—sent prepaid as above indicated, upon receipt of price. All equipment necessary accompanies each machine. **Send for Catalogue.** Send money by Registered Letter, Post Office Order, or New York Draft to

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☞ *See first page* SCIENTIFIC AMERICAN *of May 16, 1896.*

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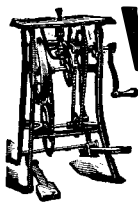

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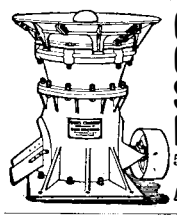

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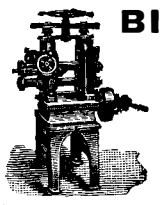

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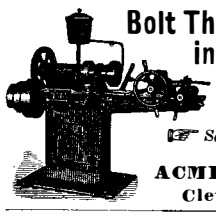

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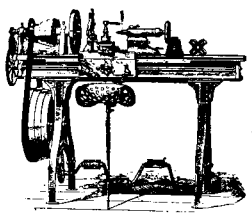

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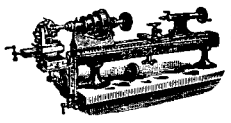

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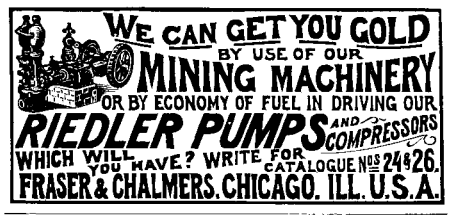

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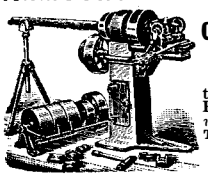

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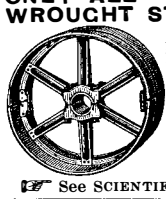

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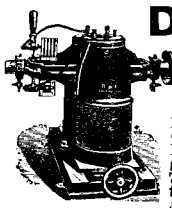

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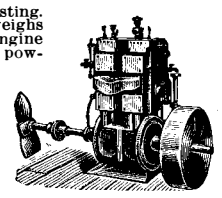

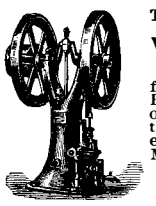

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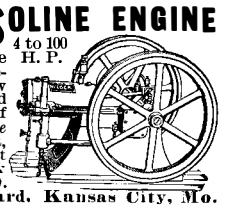

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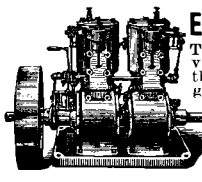

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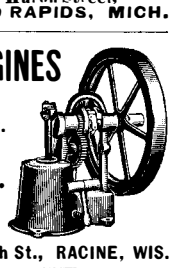

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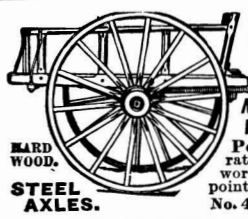

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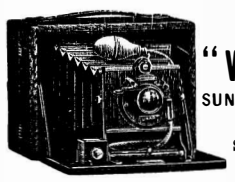

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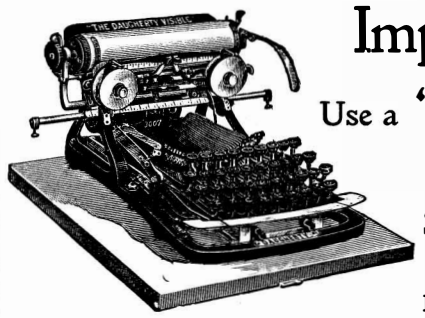

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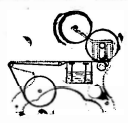

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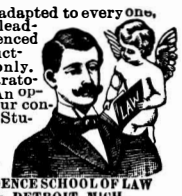

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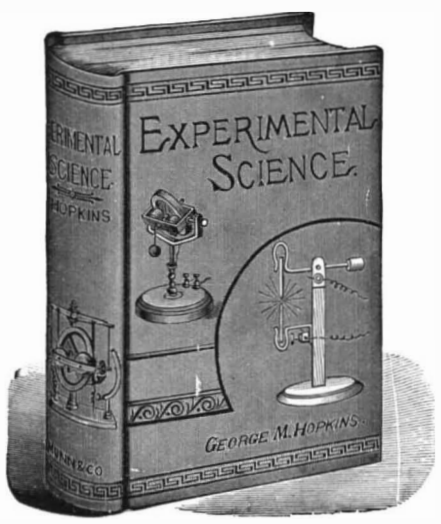

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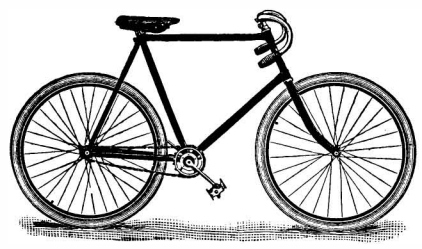

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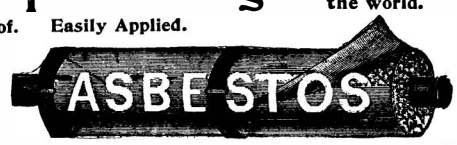

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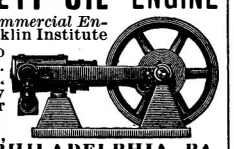

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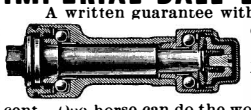

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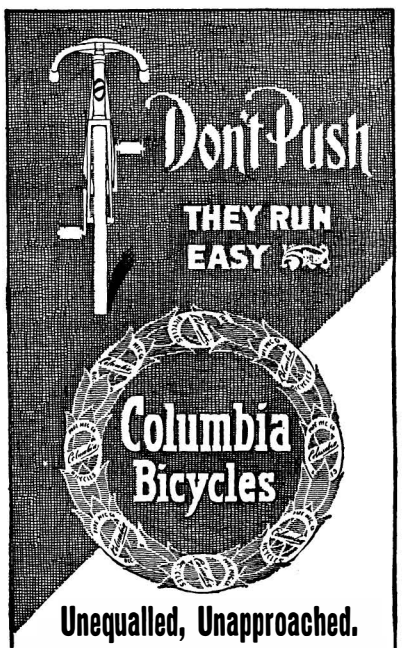

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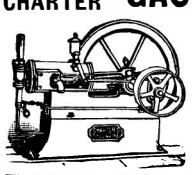

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